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THE MEEK SHALL INHERIT.

A week or two ago considerable trouble was caused at Shelter Island by a horse which bolted incontinently upon the appearance of an automobile in that charming Long Island seaside resort. Public feeling was stirred up a good deal, locally, as there are a great many horses in use during the summer around Shelter Island, but the president of the Village Improvement Society has decided that there is no law under which the automobile can be banished from the highways. In addition to that, he has added the commonsense advice that the owners of skittish horses had better sell them and get stock that is quiet and will not scare or fuss at every opportunity to do so. In other words, the meek horse is to inherit the earth, so long as there is any room for the horse at all. He is less of an insanitary nuisance than his fiery relative which rears and bolts and smashes whenever he can, and he may be tolerated until the automobile is perfect.

POLITE CONDUCTORS.

In one of the latest of his books, "Their Silver Wedding Journey," Mr. W. D. Howells describes with great circumstantiality a German trolley conductor who had the manners of a Mr. Turveydrop. He got off the platform when the passengers entered the car, stood in the road until they were safely aboard, let them settle down slowly and snugly into their seats before starting the car, touched his cap to them when respectfully asking for the fare, got off first to help down dismounting passengers, and even refused to take fare from passengers who after riding some distance alleged that they had unintentionally got upon the wrong car. All of this makes delightful reading, but as the book purports to be a true picture of travel, its author appears to have assumed for it rather improperly the poetic license not in general extended to prose. We have had our own doubts about it, and now note that a correspondent of one of the New York dailies scoffs at Mr. Howell's urbane conductor as a mere figment of the imagination.

We take it that trolley conductors are pretty much the same all the world over. The writer in Germany says that during a residence of fifteen years there, he has never once seen a conductor do any single one of the graceful acts that Mr. Howell noted so dutifully. We may remark that in some of the country regions of America we have seen conductors do nearly all these things, short of mere servility, but such actions are naturally rare in the cities because, as was suggested in these columns last week, "Step lively" goes necessarily with a swift schedule and crowded traffic. But even in the cities, such companies as the Metropolitan Street Railway of New York do a great deal by solid incentive and by tokens to be seen of all men, to encourage politeness in their conductors. One need not go to Germany to find good trolley manners.

ELECTRICITY AND INSANITY.

In another column is a brief notice of a pamphlet written to expose the malevolent use being made of electricity in certain insane asylums, which consists in its employment to drive to insanity the

normally sane inmates with whom the author apparently believes such institutions are peopled. We have often conjectured whether the lay reader seriously accepts the constant announcements by the newspaper press of the discovery of transcendentally wonderful electrical phenomena. As the writer of the pamphlet referred to is undoubtedly insane, evidence is thus furnished that the stories at least appeal powerfully to one of diseased mind. The writer approaches the subject with a survey of the wonders of electricity, in the course of which there are frequent quotations from the yellow journals and yellow magazines. The New York *World* is quoted as authority for a discovery by one Smith, "a young workman in a tin factory," that electric waves can be projected 150 miles through the air, and have "a width of only one inch in passing"—which small dimension appears to the writer of the pamphlet to be of extraordinary significance. The same journal is quoted as announcing the discovery by an Austrian of a new force in nature, consisting of an electrical fluid more marvelous than the X-ray, which not only generates light and heat, but has the power of controlling the action of any one within its zone. *Pierson's Magazine* is given as authority for the invention by a young Swede of a new form of "invisible light," having marvelous properties. "When," says the writer of the article quoted, "I asked Mr. Orling for a full description of the rays, he prudently refused to reveal the secret, but asked that they be described not as X-rays, but as Y-rays." The writer of the pamphlet above referred to evidently fully believes that the authorities of insane asylums have discovered the secret of the Y-rays, and possibly also that of Smith's invisible current one inch wide, and are employing them both to craze their patients. The author adds the following for the benefit of others who may suspect that their sanity is being similarly trifled with: "As the earth's electrical current always flows to the north, the compass needle will show, if you are careful, that the currents have thrown it off the meridian." The object of the pamphlet is to call for an investigation of a certain asylum mentioned by name, the doctors of which have, by electrical means, it is alleged, not only driven their own patients insane, but "have their own confidence men outside to assist in the work." It is somewhat surprising that the article did not appear in one of the yellow magazines, instead of in a dingy little pamphlet, without illustrations.

HISTORY OF THE PRIMARY BATTERY.

An article in one of our English contemporaries on the history of the primary battery is remarkable for its omission of any mention of the name of Becquerel, the discoverer of the principles of polarization, which discovery immediately led to his invention of the two-fluid or constant-current cell. The English writer does not in words deny credit to Becquerel, but in the chronology of the primary battery he begins his reference to two-fluid cells with those of Daniell and Grove, the dates assigned being 1836 and 1839, respectively. In passing we might remark that the credit for the Bunsen cell is transferred from the late German professor to an Englishman. As the prior work of Becquerel is authenticated by early publication, it is surprising that his claims should have been ignored. In 1829 Becquerel laid down the principles of polarization, showing it to be due to the presence of elements deposited from the electrolyte, whose effect is to set up an opposing e. m. f. He pointed out how this might be avoided, and described a cell in which a parchment diaphragm separated the polarizing fluid (nitrate of copper) from an exciting fluid (nitrate of zinc). In 1835 he constructed a similar cell, in which the polarizing fluid was nitric acid. A year later, Daniell brought out the cell which bears his name, and which was identical in principle with the earlier one of Becquerel, but had a more practical form. In 1839 the Becquerel principle was also applied by Grove, who credited the French savant with priority over Daniell. As the article to which we refer is, apparently, to form part of a treatise on the primary battery, we think it would be well for the writer before publication of the book to investigate whether he is justified in entirely ignoring the work of Becquerel.

THE ENERGY OF CARBON.

Mr. Reed's paper upon the prospects of obtaining the energy of carbon by voltaic means is concluded in this issue. Incidentally it is pointed out that the ordinary zinc consuming voltaic cell is in one sense an indirect and necessarily imperfect accomplishment of this result, seeing that carbon has to be burned in a furnace in order to supply the energy necessary to free zinc from combination in its ores. The potential energy of the zinc is, therefore, a part of the potential energy of the carbon so consumed. In the main, the conclusions of the paper are not encouraging to those who seek an economical solution of this enormously important problem. There seems, however, to be no necessity to believe the solution impossible. Even if it be admitted that no electrochemical combination exists in nature from which electrical energy can be obtained by the direct oxidation of carbon, still the undoubted fact that we only secure at most less than 30 per cent. of the energy of carbon in the most efficient gas engines, leaves the problem of securing a larger yield and a lesser waste open to the entire attack of all physical methods and invention. The present waste is so completely an incident to our environment as distinguished from a general law or necessity, that the future should have the solution of this problem in store for us.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

In another column we print a report of the Columbus meeting of the American Association for the Advancement of Science, and herewith offer an apology to our readers for its brevity and incompleteness. Although we had a capable representative at the meeting, the absence of facilities for obtaining abstracts of, or access to, the papers presented, largely nullified the effort made to present a report of the meeting worthy of a body purporting to represent American science, and which would do justice to the high character of the contributions to the proceedings in the form of papers. We are not alone in this criticism, for the newspaper despatches from Columbus refer in emphatic terms to the entire lack of press facilities. We may add that previous to the meeting we were unable even to obtain complete lists of the papers to be read before the Association.

As compared with the history of the British Association, the career of the American Association in recent years has not been such as to excite much patriotic feeling, and this we believe is to a great extent due to the lack of management which was so largely in evidence at Columbus this year. Whether this follows from lack of organization in administrative departments or lack of funds for their proper conduct, we cannot say. The fact remains that the meeting of the American Association is far from being one of the national events of the scientific year, as is the case with the British Association; and instead of papers read before its meetings having a wide duffusion, the audience which they reach is actually circumscribed to a minimum. In a recent number *Science* refers in guarded terms to the undeniable decay of the American Association, and suggests a number of remedies. To these we would add the organization of a permanent secretariat, which on the eve of meetings shall through the newspaper and technical press, work up a wide interest in the objects of the Association; and by preliminary work and during the meetings make such dispositions that the proceedings shall through the press have the widest possible diffusion among the classes to which the various subjects treated particularly appeal.

THE ARMATURE REACTION IN INDUCTOR MACHINES.

In an interesting letter by J. Fischer Hinnen on another page on the subject of two-phase vs. three-phase systems there is given considerable information on the subject of armature reaction and the mutual reaction of the several phases of polyphase machines. The proposal made in a previous letter by the same writer and upheld in this one to wind the two phases of a two-phase machine respectively on the two armatures of a two pole-ring inductor dynamo seem to be worthy of further discussion.

The subject of the mutual reaction of the various phases is a difficult one to clear up thoroughly, owing to the influence upon it of the constantly moving field circuit. Outside of this and of the influence of the end connections of the armature coils, the currents in the armature windings exert a general effect upon the field strength which it would appear would be practically as serious in a machine wound with the two phases on two separate armatures energized by one field as in the ordinary two-phase type, as was argued by Prof. Blondel.

It is well known that an alternating current traversing coils moving synchronously with the current past the poles of a magnetic circuit affects that circuit very much as does a direct current passing through the same coils, but not moving. Such synchronous currents are set up in the armatures of alternating current generators. If these armature currents are polyphase the effect is continuous and virtually uniform. If the armature current is single-phase the effect is that of a pulsating direct, or what might be called a sine square current. If the current is in phase with the impressed e. m. f. the effect upon the field circuit is purely a distorting one. If the current lags behind the impressed e. m. f. the effect is a demagnetizing one. If it leads the e. m. f. it tends to increase the magnetization. This tendency, while a fluctuating one in single-phase machines, is smoothed out into a more continuous action by the foucault currents generated in the solid iron of the magnetic circuit and is rendered even more completely uniform and less pulsatory by any such short circuiting device as the "amortisseur" described by Mr. Fischer Hinnen. This general effect, as a rule demagnetizing in character, would be exerted by each phase of a two-phase inductor machine were they wound together on both armature rings or each on one. Any alternating mutual induction tending to not only vary the relative strength, but also the phase relation of the currents in the two phases, would undoubtedly, as argued in the letter referred to, be greatly diminished by such a division of the phases.

LOW FREQUENCIES VERSUS HIGH FREQUENCIES.

The question as to what particular frequency of alternating current should be used for a given system is one which has occupied a great deal of attention on the part of electrical engineers, and concerning which much difference of opinion exists. Like nearly all such questions the decision is practically controlled by commercial considerations, while it is theoretically controlled by a number of separate engineering considerations which lead to a compromise between certain extreme limits. A particular frequency is usually adopted for the reason that machinery for that frequency is offered for sale by the manufacturers. The manufacturers in their turn are guided in their adoption of a given frequency by a variety of economical considerations, some of which are mutually at variance. In Europe a great number of different frequencies are employed, ranging between 40 and 120. In this country there are about half a dozen different frequencies ranging between 25 and 140. The development of these various frequencies has a history brief in point of time, but full of engineering interest.

Certain fundamental conditions affect frequencies in general. In the first place, high frequencies generally entail high speeds of generators and motors; either high peripheral speeds, or high rotatory speeds, or both, in order to obtain the necessary number of passages of a coil in front of successive magnet poles in unit time. In other words, high frequencies and high speeds usually go together, although there is no rigid connection between the two. In the second place, high frequencies are the equivalent, in stationary induction apparatus, of high speeds in moving induction apparatus; so that just as high speed motors are capable of a greater output per pound than low speed motors, high frequency transformers can be built lighter than low frequency transformers, for the same output. Finally, in the transmission lines frequency plays no part except in the capacity and inductive effects which increase with it; since a given pressure, current, and phase difference in the transmission lines represent the same power, whether the current be reversing rapidly or slowly. Consequently, frequency only affects the question of line construction in regard to the limits of regulation.

Although high frequency tends to reduce the weight of copper and iron, it tends to increase the hysteretic waste of power. It also tends to give instability in synchronizing and maintaining synchronism. Broadly, therefore, the lower the frequency the lower are the speeds of rotation, the better the behavior of synchronous motors and generators, and the less the inductive effects in lines and apparatus; while the higher the frequency up to certain limits, the lighter the machines. Consequently, the frequency cannot be made too low without making the machinery too heavy, and it cannot be made too high without making the machinery hard to control.

In the early days of alternating current system in the United States, when only lighting circuits were operated, high frequencies were adopted for economy in machines. Latterly the introduction of motors and the parallel running of generators has brought the frequency much lower. If motors only were to be considered, the frequency which would have the advantage would be the lowest in use. But high economy lamps begin to flicker at a frequency of 30, unless the current waves are relatively flat. Alternating arc lamps require at least a frequency of 40, and behave best between frequencies of 50 and 60. The ideal conditions, therefore, seem to require for mixed systems of arcs, incandescent lamps and motors a frequency of 60; for motors alone 25, and for both motors and incandescent lamps either 30 with a sinusoidal wave of E. M. F., or 25 with a flatter wave. It seems quite possible, therefore, to operate all systems at present known with practically two frequencies, namely, 60 and 30. Although a considerable quantity of apparatus is still built for 120 or more, yet this is almost wholly in order to supply stations fitted with older forms and designs of machinery. As a matter of fact, however, the frequencies of 60, 40, 30 and 25 are all in existence in America, and they seem likely to persist in the near future. Once apparatus has been built and standardized, it possesses a sort of inertia, by reason of which it tends to remain in use even although somewhat better results could be obtained by a change. It becomes known, and its good behavior is a guarantee of future performance. There is also a certain amount, often a considerable amount, of capital invested in the tools, patterns and plans from which the apparatus is constructed, which it would be absurd to destroy, except under pressure of necessity or great desirability. For this reason improvements in systems of machinery always lay behind improvements discovered in methods of operation. The lag is, however, notably less in the United States than in any other part of the globe.

New York State Street Railway Association.

The seventeenth annual meeting of the Street Railway Association of the State of New York will be held at Ithaca, on Tuesday and Wednesday, Sept. 12 and 13, 1899. The street railroads of the State are already evincing a wideawake interest in the event, and it is expected that the convention will surpass all former ones in point of attendance and interest. The progamme of entertainment, arranged by the Ithaca Railway Company, is varied and comprises an inspection of Cornell University, a trolley ride to the picturesque environments of Ithaca, a trip through Cayuga Lake with lunch served on the boat, a special entertainment and band concert at Renwick Park and the customary banquet Tuesday evening, Sept. 12, to which supply men are invited. The usual charge of $5 will be made.

Ample space (in close proximity to the place of meeting) for the exhibit of supplies, models, etc., will be furnished free of expense to those who desire to avail themselves of the privilege. A number of interesting practical topics will be discussed at the meeting. Mr. G. Tracy Rogers, of Binghamton, is president.

Special Lighting for Dewey Night.

Admiral Dewey is expected to arrive in New York Harbor on Sept. 28, and the same Thursday evening, as well as Friday evening, after the land parade, special lighting displays are to be made, chiefly with the aid of electricity, that will far excel anything New York has seen before. For the first time, on Thursday night, the great span between New York and Brooklyn will shine out a "Welcome, Dewey," in letters thirty-six feet high. The legend will be 300 feet long, and more than 8000 electric lamps of high candle power will be used to form this mid-air signal of welcome to the Admiral. The device will be strung on the central part of the span, between the towers, and above the railroad tracks, so that it can be seen and read up and down the East River, as well as for miles down the Bay. The lights forming the letters will be pure white, and at each end of the design will be appropriate embellishments. The reflected light from this display, which Warren W. Foster, secretary of the committee, says will be the greatest display of electrical illumination the world ever has seen, will be visible in every direction for many miles.

The bridge will be decorated by day with bunting and flags its entire length, but its greatest glory will be seen by night. In addition to the great centre illumination there will be many other lights, and from the towers four great searchlights will play in every direction. Bridge Commissioner John L. Shea and Chief Engineer C. C. Martin are in charge of the display, and Mr. Martin has reported to the committee that work had been begun already.

The ferry companies' slips and the steamship and railroad piers along the East River will be lighted, and their electric designs will be varied, according to the taste of their designers and the plans of the chief engineers. On the North River, where the larger railroad and steamship lines have their terminals, the display will be even more brilliant. The Pennsylvania Railroad was the first to submit a plan of its illumination of the Jersey City terminal to the committee. On the great train sheds facing the water will be the words "Welcome, Dewey," in enormous letters of electric lamps, with the facade of the station picked out in electricity. The Delaware, Lackawanna & Western Railroad also has reported its plans to the committee. They were designed by Paul H. Brangs, the company's chief electrician, and they show an elaborate display at the Hoboken terminal. The legend of welcome to the Admiral will be in letters eight feet high, made up of electric lamps and surrounded by embellishments in both white and colored lights. Several thousand electric lamps will be used in the illumination. The ferry houses on this side of the river will be illuminated, also, on a lesser scale, and all the water front property of the company will be decorated with bunting profusely for the days of the land and water parades.

All the other railroad companies have made plans as elaborate and complete as these two. Private and corporate owners of piers on both rivers have been seen individually, and have given their plans confidentially to General Howard Carroll, who is chairman of a sub-Committee on River and Harbor Decorations, and the promise of a continuous blaze of electric light for miles along each bank of the two rivers may be expected confidently to be fulfilled. Many of those who will illuminate desire to keep their plans and designs secret for the present.

The City Hall Park and the hall itself, as well as the Borough Hall in Brooklyn, will be illuminated under the direction of the subcommittee of which Lewis Nixon is chairman. Mr. Nixon has received a design from the Edison Electric Company, calling for the greatest illumination that old City Hall Park ever has seen. Strings of electric lamps are to be festooned among the trees, across the walks, around the fountain and everywhere that there is a peg or branch to hang a lamp upon. These lights will be colored as well as white, and arc lights will be hung in arches at a greater height also, showing a variety of colors. The hall itself will be ablaze with lights, which will show its decorations of flags and bunting by night as well as by day. Similar illuminations are projected for the Borough Hall in Brooklyn.

None of the above preparation includes the lighting of yachts, steamers, private residences, office buildings or stores, for which a large amount of work is now being done or is to be taken up during the coming week.

An Electric Road for the Catskill Mountains.

A mountain railroad scheme has been formulated by the owners of the Otis Elevating Railway, which transports tourists from Catskill, Greene County, to the top of Kaaterskill Mountain, in the Eastern Catskills. If it goes through the Otis Elevating Railway will next year practically control Catskill Mountain travel, and the Ulster & Delaware and Stony Clove & Kaaterskill Railroads, along the choice route to both the Eastern and Western Catskills, may lose the monopoly of traffic which they now have. It is the plan of the Otis Elevating Railway to build an electric railroad from Saugerties, Ulster County, to Catskill, Greene County, connecting there with the railway. The Otis syndicate has already surveyed the route of the proposed electric road and the right of way has been secured. Construction of the road will begin within a short time. The expectation of the Otis Elevating Railway people is to grasp the main portion of the travel on the steamers of the Hudson River Day Line.

The scheme will shorten the usual trip to the Catskills by thirty-six miles. A ride of only twelve miles will take passengers to the top of the mountains. The success of other electric mountain railroads is considered a sufficient guarantee of the success of this.

The Earnings of the Metropolitan Street Railway System.

The annual statement of the Metropolitan Street Railway for its fiscal year, ended June 30, was filed this week with the State Railroad Commission. The report shows that the gross earnings of the company were $13,158,631, as against $10,730,474 for the preceding fiscal year. The operating expenses were $6,408,711, as against $5,620,484 for the previous year. The increase in net earnings amounted to $1,639,930, and the operating expenses were reduced from 52⅜ per cent. of the gross earnings in 1898 to 48¾ per cent. for the year ending with last June. The company paid $2,471,675 in dividends, an increase of $971,675 over 1898, when $1,500,000 was paid on the stock. The surplus declined from $345,570 to $167,381, a decrease of $178,189.

No track mileage was added during the year. Further, the Sixth Avenue and Eighth Avenue lines were practically closed to traffic during the months of July, August and September, on account of the change in motive power to electricity. During the first three months of 1899 also, the earnings fell off on account of the exceptionally heavy storms.

These facts show that the increase in the net earnings of the company for the year was due largely to a decided increase in regular travel. It is also attributable partly to the lower operating cost, as the result of the installation of electric traction power. That part of the lower operating expenses was due to the change in motive power is shown clearly by the fact that, while the operating expenses for the year were 48¾ per cent. of the gross earnings, they were 48⅛ per cent. during the last quarter of the year, when all of the new lines were being operated.

A 250-hp Electric Heating Plant.

IN the history of electrical development electric heating is a branch which has had a checkered career. In the early period the art was ranked with other branches in its commercial possibilities, a reminiscence of which remains in the names of "Light, Heat and Power" central station companies. Without apparently even a glance at the thermal principles concerned, extravagant predictions were made as to the application of electricity in heating houses, and inventors proceeded to devise heating apparatus apparently on the supposition that changes in form or material would influence the efficiency of transformation.

As might have been expected, a reaction occurred, and for a considerable period electric heating was almost totally discredited. During the past few years the tide of opinion has been turning, and at the present time it is generally recognized that for special purposes there is a wide and profitable field of application for electricity in heating. The two main considerations which uphold this conclusion are that, notwithstanding a necessarily greater cost for a heat unit produced electrically, the waste in the application of electric heat is a minimum, while its localization and control are vastly superior to what is possible with any other method of applying heat. In hat making, particularly, as will be seen later, the two latter factors are of immense importance, and it is therefore not surprising to learn that an electric heating equipment for hat factories is coming to be considered indispensable. In view of this fact, we give below a description of such an equipment recently installed in the hat factory of F. Berg & Co., Orange Valley, N. J., where no less than 250-hp of electrical energy is used for heating purposes.

Before entering into the details of the equipment, it is of interest to note the admirable manner in which the plant has been designed to balance the two kinds of heat required in a hat factory—that of low degree for the sizing and coloring vats, etc., and that of high degree for hat finishing tools. In the Berg plant the latter is supplied by electricity, and the exhaust from the electrical generating plant is utilized for all the various other purposes not requiring a temperature beyond that thus furnished. Indeed, in this case the balance is so perfect that the entire exhaust the year round is condensed in doing useful work, the building in the winter being heated by live steam.

The electric generating equipment consists of a 150-kw Crocker-Wheeler belted generator and a 60-kw direct-connected set, the latter being in reserve for service when the main engine is shut down, and, if necessary, to carry the lighting load. Owing, however, to the manner in which the heating load drops off towards the evening, it is probable that the main generator will be able to carry the entire winter lighting load. The generator voltage is 125, and the average load about 1200 amperes, but in starting up in the morning it sometimes goes up to 1600 amperes.

The interior is lighted by 800 16-cp incandescent lamps and 20 enclosed arc lamps. As the building was formerly lighted by but 400 gas jets, the present illumination is a vast improvement, and enables better service to be obtained. This is true with respect to both quantity and quality of product, owing not only to the increased quantity of light, but also to the superior healthfulness of the atmosphere. Fig. 6 shows a curve of a daily load. It will be noted that in the morning the load is higher, the increase being due to the preliminary heating of the irons. The better efficiency of the workmen at the beginning of the day is illustrated by the manner in which the load falls off as the working day draws to a close. With the exception of about 100-hp for forming machines situated close to the engine room, all of the power of the factory is distributed by electricity. A 5-hp motor drives several machines in the inspection department and one of 25-hp is used in the "pouncing" department to drive lathes on which hats are put through the first process of finishing, when the surface is smoothed down by "pouncing" paper. Motors are also used to drive the machine irons, curling machines, sewing machines and for several other purposes.

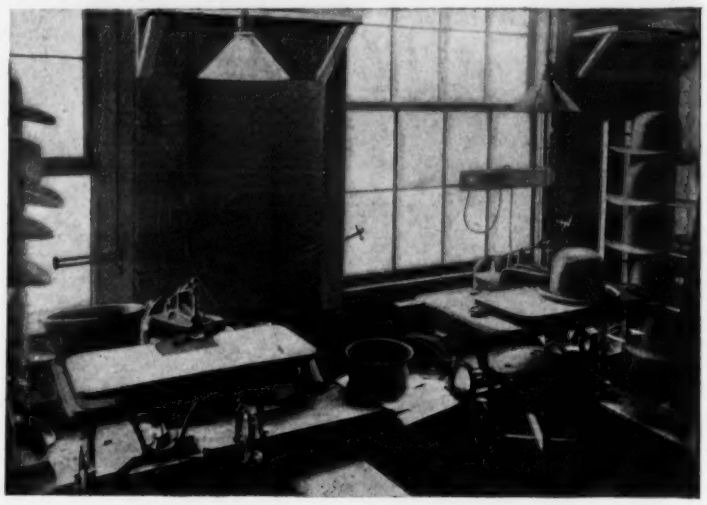


FIG. 4.—ELECTRIC CURLING MACHINE.

In order to appreciate the requirements to be met it will be desirable to take a short glance at the several processes of hat manufacture. The material for a hat as it goes into the department where it is shaped into the latest styles, is merely a piece of fur felt in the form of a clown's hat. The shaping process consists in placing this on one or more blocks and then bringing it to the finished shape by means of heat applied by irons. The different parts of a hat are not of equal thickness, the brim being the heavier and the crown the lighter portion. Consequently, different degrees of heat are required when finishing different portions of the hat. It is through fulfilling in an ideal manner this

FIG. 1.—HAND FINISHING ELECTRIC IRONS.

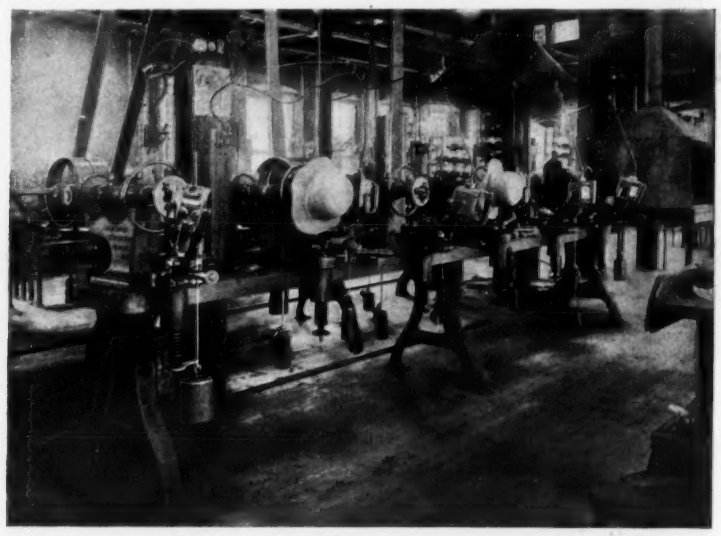


FIG. 2.—MACHINE FINISHING ELECTRIC IRONS.

requirement that electric irons have given such extreme satisfaction, as not only can different degrees of heat be supplied at will, but any desired temperature may be indefinitely maintained at a given point.

Previously, two kinds of irons were employed in hat making, one of which was heated by a red-hot slug and the other by gas jets. In the first case the iron was either abnormally hot at the beginning of the operation, or was apt to be used when it was

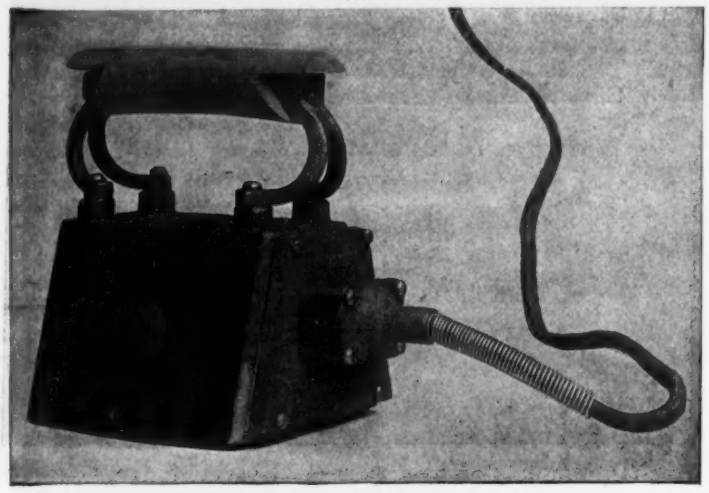


FIG. 3.—ELECTRIC IRON.

at too low a temperature, and the heat was imperfectly localized. In the case of the gas iron, it was even more difficult to localize the heat where desired, and the user was exposed to noxious fumes, while the great heat thrown off from the flame rendered his working over the iron a disagreeable task, which in warm weather became almost unbearable. On the other hand, the resistance in the electric iron is so placed and so insulated thermally

FIG. 5.—ELECTRIC FLANGING PAD.

that the escape of heat is only from the working surface, thus causing the least possible discomfort, even in the warmest weather.

In making the hats the higher grades are shaped with hand irons and the cheaper ones by ironing machines. Fig. 3 shows one of the irons used on the machines, which differs, however, very slightly from that used by hand, as will be seen by reference to Fig. 1. Just previous to placing a hat on the block, the workman closes a switch at his bench, which turns the current on such that when the hat is ready to have heat applied, the temperature of the iron is at the proper degree. The switch is kept on until the heavier portions of the hat are gone over, when the current is turned off and the temperature gradually lowers as the crown is approached. Should it be necessary to linger over any portion of the hat longer than usual, the switch may be again thrown in, the operator being thus always able to fix the temperature of the iron at the point most desirable. Fig. 1 gives a view of a section of a bench where hats are thus finished by hand. The hand irons take five amperes at 120 volts, but, as stated before, are not constantly in circuit.

The apparatus for electric machine ironing (Fig. 2) is not only ingenious, but extremely economical in labor, one boy being able to attend to six machines. In this case, after the hat is put on the block, the iron is placed at the beginning of its course close by the rim, and is then automatically and slowly carried along the blocked hat, being also given a species of rolling motion in order that it may more perfectly accomplish its work. When it finally reaches the crown, the iron is automatically thrown off, and the machine stopped.

In this case again electric heating has shown its perfect adaptability to the end in view. Formerly the heat for the machine irons

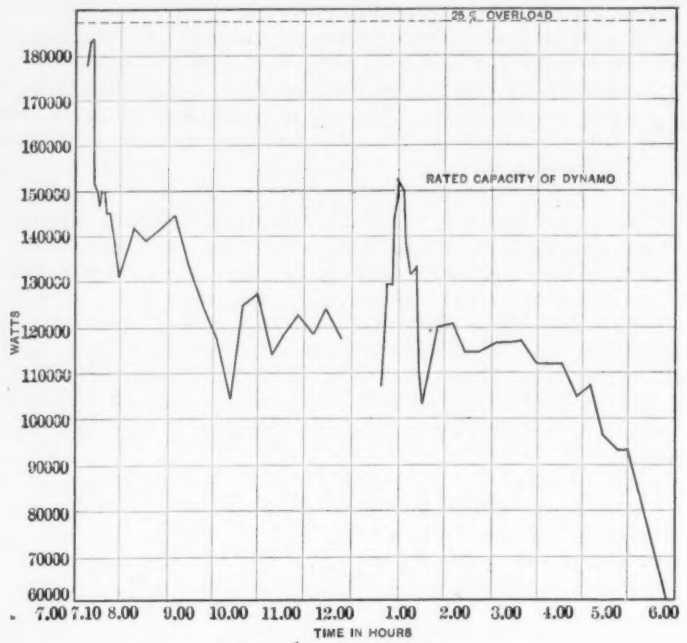


FIG. 6.—LOAD CURVE.

was supplied by gas jets, and close attention was required that the temperature did not become too high or too low. With the electrical attachment little or no attention is necessary, and it has been found that the services of a boy can be utilized, who, moreover, can attend to six machines. Thirty-six of these machine irons are run by an electric motor of 2-hp.

Before leaving this department of the Berg factory, we may note a further contrast which presents itself between conditions of working under old methods and the present ones. In each of the several hand finishing rooms there are about 125 men employed, and when hot slugs were used it was necessary to replace at short intervals those that had been cooled with others taken redhot from the furnace. To heat the slugs there were three furnaces on the floor, consuming three tons of coal a day, and, naturally, causing an almost unbearable heat in hot weather. Moreover, the periodical journeys of the men from their tables to the slug furnaces reduced their productive capacity, and the constant stream of men going to and fro congested the passages and disturbed those at work. At present it is not necessary for a man to move from his particular part of a bench during the working day, and his attention is not distracted from his work, it only being occasionally necessary for him to throw in or out a small switch placed on the wall within easy reach.

Fig. 4 shows an electric curling machine, which machine is used in curling the edges of hat brims. The process consists in pressing the edge of the hat against a heated groove of such shape as to give the desired curl. A small revolving wheel of the proper shape at its circumference forces the rim into a recess in the hot iron, the surface of the recess being electrically heated by an interior resistance. Formerly the curling iron was heated by gas, which necessitated an ungainly apparatus with, as usual, heated fumes therefrom affecting the comfort of the workman, while soot was apt to ruin an occasional hat, and the degree of heat could never be absolutely relied upon. The electrical apparatus is very small in dimensions and obviates all the objections above referred to.

Fig. 5 shows a flanging pad for giving the rim of a hat its definite form. This consists of a pad of asbestos, in which is imbedded an electrical resistance, the whole being enclosed by a linen cover. The hat being blocked, the pad, which is also weighted, is placed

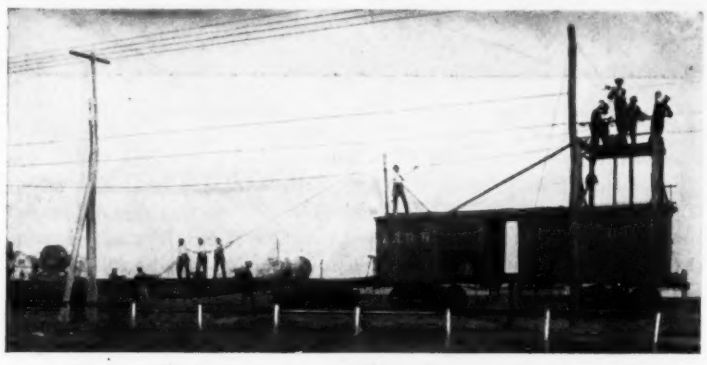
on top of the rim and left there a sufficient length of time to cause it to assume a definite shape. The use of electricity here also resulted in a great amelioration in working, as previously the pad could only be superficially heated by being placed upon a steam table, the waste heat from which caused discomfort to the workmen.

As to the economy of electric heating in this particular application, we have the following figures. Formerly eight tons of coal were used per day, and at present, with one-third greater capacity, ten tons are used. In addition, the gas bill was formerly $200 per month, and the fuel for, and attendance on, the slug furnaces, amounted to $10 per day. This, however, does not entirely represent the economy derived from the use of electrical apparatus, as the percentage of hats injured in process of finishing is less with the use of electric heat. Nor should the increased comfort of the workmen be neglected, this resulting in increased productive capacity of the plant.

The plant was designed by the Hadaway Electric Heating & Engineering Company, of New York, in all of its details. The same company furnishes the generators, motors and all heating apparatus, the whole being installed by Mr. Grant Freeman, superintendent of the Berg Company.

Combined Operation of Trolley and Steam Systems on the Long Island Railroad.

LONG ISLAND has witnessed this summer along its "sea girt shore" the trial of a very interesting experiment by the Long Island Railroad in the combination on its New York and Rockaway Beach Division of steam and trolley service. This division enjoys a very large proportion of the special pleasure travel from New York and Brooklyn to the Rockaway beaches, and



EQUIPPING LONG ISLAND RAILROAD FOR TROLLEY WORK.

has also in such settlements as Averne, Far Rockaway, Lawrence, Cedarhurst and Woodmere a heavy and profitable traffic due to the pressure of hundreds of well-to-do "cottagers" and "residenters," who find it convenient to be near the city in summer for professional and business reasons, or else like to occupy their handsome country homes all the year around. These wealthy villages are strung all along the narrow shelf of beach that fronts on the Atlantic and that rests in the rear on picturesque Jamaica Bay, where thousands of amateur fishermen and regular oystermen are to be seen daily. Out of all these conditions, radical difficulties in handling the traffic have sprung up. Increasing the steam service would not solve the problem, nor was there physical room for separate trolley tracks for the passenger business between Rockaway at one end and Far Rockaway at the other; so the Long Island Railroad Company has adopted the method of converting that part of its "Jamaica Bay Route" into a trolley road. We can state from frequent personal observation that this solution of the problem is proving very successful. A large traveling public asking for better facilities has been satisfied, new travel has developed wonderfully, and the Long Island management, if we are correctly informed, is greatly encouraged in its ideas looking to the adoption of this plan for other sections of its large network in various parts of Long Island between the Sound and the sea.

Herewith we illustrate a few features of this interesting and suggestive experiment, which, while not altogether novel, is still so unusual as to be the subject of close study by many steam railroad men and electrical railway engineers in this part of the country. The current for the enterprise is being furnished by the Queensborough Electric Light & Power Company, who have a fine, new plant at Far Rockaway, one extreme of the trolley section, the power house fronting on an arm of Jamaica Bay. The company having entered into a contract with the Long Island Railroad for the supply of direct current for operating a portion of the railroad system, arranged to utilize its two-phase General Electric generators for this purpose by the installation of two 100-kw oil insulated Westinghouse step-down static transformers to reduce the electromotive force from that of the generators to

STORAGE BATTERY ROOM FOR TROLLEY LINE.

that which is suitable for the 200-kw rotary Westinghouse transformer, which runs at 720 revolutions per minute, and transforms the current supplied by the alternating generators to a 575-volt direct current, suitable for railway purposes.

To supplement the rotary transformer and give a regulation and economy otherwise impossible to obtain, the company has installed in a building provided for that purpose by the Long Island Railroad at Hammels (situated in Rockaway, about 4½ miles from the power station) a storage battery supplied by the Electric Storage Battery Company, of Philadelphia, consisting of 252 type 11 E. cells, which are supposed to carry a load of 100 amperes for a little over an hour. The current is carried from the power house

TROLLEY CAR RUNNING ON LONG ISLAND RAILROAD.

to and from the track, a distance of a little under one mile, by two 500,000 circular mill stranded wires, heavily insulated. One of these is the feeder and the other the ground return. The feeder is carried from the point of intersection with the railroad to the battery at Hammels, being connected on to the trolley wire every 1000 feet. The trolley wire is 00, of the grooved type, manufactured by the General Electric Company, all fittings and parts for the wire work being supplied by that company.

It was found necessary in erecting this wire to use a train, as the track was being constantly used for the regular steam service, which is very heavy and continuous in summer. For this purpose a locomotive, a flat car and a box car were used. It was necessary, owing to the freight service, that the wire should be at no point less than 21 feet from the top of the rail. A platform was accordingly built upon the box car, and the wire reels erected on

the flat car, the wire being strung out and looped into position, after which heavy blocks and clamps were placed upon the two ends of the wire, the engine was detached from the train, and the slack of the wire was pulled up by means of the locomotive, this being a very quick operation, and, of course, more efficient than the regular work by hand.

The final work was done at night, it being so late in the season by that time that one branch of the track was being used by trains every fifteen minutes. For this purpose the builders used the ordinary kerosene blow torches, which were found to be most efficient. Towards the latter end, when the work was done on simply the fittings on the line, the linemen arranged a bank of lights on their car, which they took from the hot wire.

The bonding was done with a protected rail bond, made by Forest City Electric Company, of Cleveland, of the flexible type, having a 7-inch span and a ¾-inch lug. This bond goes under the fishplate, and while it necessitated a good deal of labor in the equipping of an old track, by reason of the removing of the fishplates, spikes, bolts, etc., it furnished a very complete bond, and one that is safely protected from stealing. It was found that the men using a Q. and C. No. 4 rail drill could drill one ¾-inch hole in an 80-pound steel rail in four minutes, this being the time for the drilling of the rail alone. It was found that they could work two drills on the same rail joint, and in this manner were enabled to drill out a three-mile section of live track without holding a train for a moment.

The cars now in service are of the open type, double truck, with General Electric standard equipment, and may be seen running at frequent intervals. It is not at all an uncommon sight to see a trolley car with its load of passengers waiting right behind a steam train at a station and moving up to the platform as the train goes out. The cars do not make irregular stops like ordinary street cars, but in addition to the Long Island stations scattered thickly along the five miles of route, several special stopping places are designated by signs, and are located at points where the suburbanites, so to speak, of each village or resort can be most advantageously served. This is greatly appreciated by the public. Only 5 cents fare is charged for what is one of the prettiest and breeziest rides in all Greater New York, and the Long Island Railroad is to be complimented upon its innovation. We are indebted to the courtesy of Mr. H. B. Fullerton, special agent of the road, for some photographs and for facilities in the collection of the above data.

New Work at Niagara.

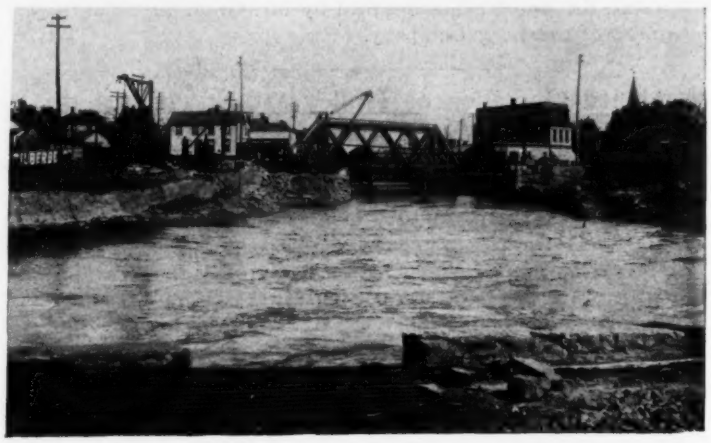
BY ORRIN E. DUNLAP.

The work that is being done this year by the Niagara Falls Hydraulic Power & Manufacturing Company is of a very notable character. It will be recalled that the power station of the Niagara Falls Hydraulic Power & Manufacturing Company is located at the water's edge in the gorge. There are now in operation in it four turbines made by James Leffel & Co., of Springfield, Ohio, and one made by R. D. Wood & Co., of Philadelphia. These turbines are direct connected to generators which supply current to the lower works of the Pittsburg Reduction Company; the plant of the National Electrolytic Company; for the operation of the Lewiston & Youngstown Railroad, and the Niagara Gorge Railroad; to the Buffalo & Niagara Falls Electric Light & Power Company for incandescent lighting; to various users of electric motors, and to an alloy smelting company.

The Pittsburg Reduction Company have enlarged their lower Niagara works on the lands of the Niagara Falls Hydraulic Power & Manufacturing Company, and in order to furnish the necessary increased amount of electricity, the power company is now installing two new turbines of R. D. Wood & Co.'s make, and these will be direct connected to new generators that will supply the current referred to. This work of installing the new machines is going on rapidly. One turbine has been erected, and the second is on the ground. The new generators are nearly ready for operation. In addition to this the Niagara Falls Hydraulic Power & Manufacturing Company will install two more wheels, making five in all to be fed from the huge penstock that stands out in column form from the cliff, and which has a diameter of over 11 feet. When these additional wheels and generators are in place the installation of the second section of the company's power station will have been completed.

Determined to keep in advance of the industrial growth of Niagara Falls, if possible, the hydraulic company has already commenced excavating for the third section of the power house. The dimensions of this new section will be 100 by 60 feet, and this will make the total dimensions of the station 180 by 100 feet. The new section will bring the southerly line of the power house close up to the pulp mill of the Cliff Paper Company, as far as it can go in that direction. In the construction of this addition to the station, provision will be made for an electric elevator from the top of the high bank to the power house. At present the power house is reached by means of an incline in the Cliff paper mill.

The completion of this power house will by no means exhaust the company's facilities for development, for it owns quite a large amount of land along the lower river, and already the plan for a new power house has been considered. It is highly probable that when this new station is built it will be located some distance north of the present power house. It will, however, be in the gorge, at the water's edge, the prospective site being north of the Central flouring mills. This location will necessitate the exten-



ENLARGING THE HYDRAULIC CANAL, NIAGARA FALLS, N. Y.

sion of the hydraulic canal basin some distance north in order that a water supply may be furnished, but the company possesses ample land for the extensive improvements it has in contemplation. A most important feature of the prospective development is that there is a possibility that the new power house will be for alternating current, and that the units of development will be considerably larger than in the present station. Wallace C. Johnson is the company's chief engineer, and it is under his careful supervision that all the company's work is done.

During the summer the Niagara Falls Hydraulic Power & Manufacturing Company has very materially added to the capacity of its canal and basin by enlargements. This is especially true of the canal below Main street, where a new bridge has been erected in order that the waterway might be widened to full 100 feet. Extending from this point west the canal opens out until now the basin presents the appearance of a small-sized bay, giving the various consumers of water confidence that their wheels will not cease to turn for lack of water. The depth of both the canal and basin has been increased to a considerable degree. The illustration shows the new bridge in course of erection, and the canal banks broken away preparatory to the erection of massive new stone walls. Immediately under the bridge the canal is shown at its old width, while to the left, at the end of the bridge, may be seen the new retaining wall, indicating the increased width of the waterway. Mr. Arthur Schoellkopf, of the Niagara Falls Hydraulic Power & Manufacturing Company has the work under his personal supervision.

The National Electrolytic Company, of which S. P. Franchot is manager, has been most successful with its chlorate of potash process. The original building has twice been enlarged, and now a still greater extension is in building. In fact, it seems to have been a constant discovery with this company that they didn't have room enough.

The Acker Process Company, a new tenant of the Niagara Falls Hydraulic Power & Manufacturing Company, promises to be a great consumer of power. The original buildings of this company's plant are well along, but it is even this early intimated that the plans call for much more extensive building operations within the next two years.

New French Types of Automobiles.

The accompanying illustrations show two types of automobiles recently illustrated in our French contemporaries. That represented in Fig. 1 is a sweeper and sprinkler which for some time has been in service in Paris. The machine was designed by M. Locherer, a Paris municipal engineer, the object being to produce a construction that would not be expensive, and which would utilize the present forms of sweepers. As will be seen, the motive part of the combination is very compact, consisting merely of a single pair of wheels and axle supporting a platform which carries

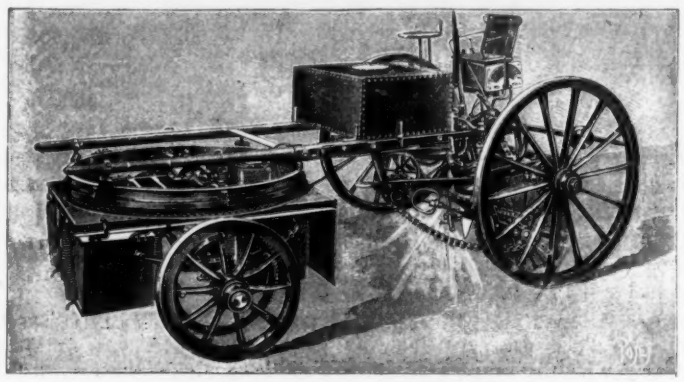


FIG. 1.

the motor, and from which are suspended, by means of springs, boxes containing the storage batteries. For the sprinkling arrangement a small electric pump is used. By means of the controller the man in charge can vary the speed from ½ to 4 miles per hour. Another lever governs an electric brake. It is found that the expense of running this machine is very small, as the municipality pays very little for its current, and the speed is so slow that but a small power is required to run the vehicle.

The machine shown in Fig. 2 is an electric hose carriage in use in Paris, designed by Captain Cordier, of the municipal fire department. The weight of the vehicle is 3800 pounds, and the total weight loaded, including the hose, firemen, etc., is 5500 pounds. A speed of from 9 to 12 miles per hour can be maintained for from 4 to 5 hours. It carries six men and the material necessary for

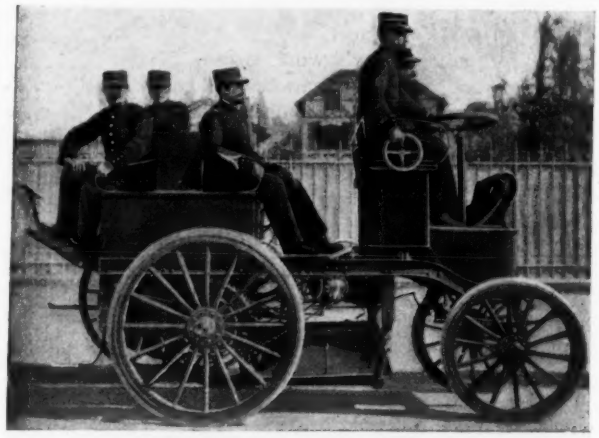


FIG. 2.

life-saving service, including 500 feet of hose, life-saving hook ladders, pikes, etc. The body and motive machinery are mounted on a steel frame, the front portion having a triple spring support on the forward axle, and the after portion an ordinary small suspension spring. The whole of the tractive effort is transmitted by means of the adjustable shaft E, (Fig 3), which is also used to tighten the sprocket chain. The body of the vehicle is divided into two parts M and N, the former constituting the seat for the two drivers, one of whom manipulates the larger steering wheel V, the controller, by means of a small wheel, the brake pedal, while the other operates the signal horn by means of another pedal. In the fore part of the vehicle, at Q, is a small switchboard carrying a voltmeter registering up to 120 volts; an ammeter; a fusible cut-out; a switching arrangement, which can be fitted either with the ordinary switch for connecting up the cables or a movable plug which, as a measure of precaution, can be taken away to prevent the vehicle from being started; a series of switches for the headlights, and the lamp for lighting the volt and ampere meters; a switch for two arc lamps of 10 amperes, which may be employed, if necessary, to light up the scene of the fire.

On the first trials, a speed of 12 miles per hour was obtained on a good level road with a discharge of 48 to 50 amperes; and a speed of 7 miles with a discharge of 35 to 40 amperes. The total weight of the battery is 1150 pounds, and it has a capacity of 160 ampere-hours over six hours, and 10 ampere-hours per pound of plate. The battery is contained in the box D, which is suspended by means of springs.

The motor armature has two distinct windings and commutators, the windings being in the proportion of 5 and 3. This admits of four combinations—either winding alone, and the sum or difference of the two windings, giving the proportions 8, 5, 3 and 2, corresponding to speeds of 12, 8, 4, 8 and 3 miles per hour. The battery coupling and field are not changed, the controller making armature connections alone. The motor, which is rated at 90 volts and 25 amperes, is very flat and scarcely visible under the carriage.

Automobile Mail Wagons.

A Washington despatch states that it is very unlikely that the Post Office Department will authorize the use of automobiles at any post office within the next two or three months at least. Applications have come to the Department from Postmasters in all parts of the country, desiring to introduce the automobile, and from firms desiring to furnish them and offering the use of different machines for experimental purposes. While the Department has a fund out of which it pays for horse hire and allowances, which, it is believed, might be diverted to paying for automobiles, it would not go very far

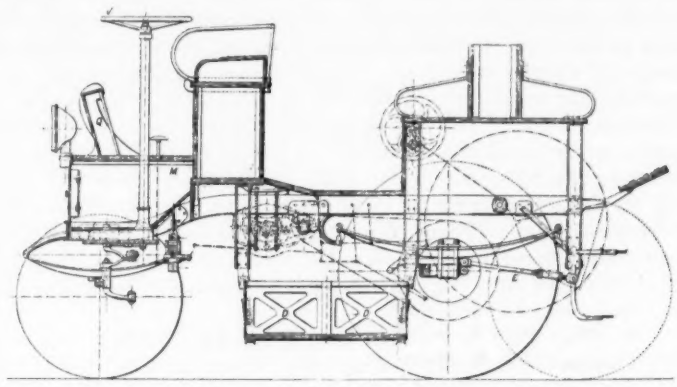


FIG. 3.

at the prices now asked for these machines. At from $500 to $1000 for each machine, the fund would be quickly exhausted. They might be rented, however, if the Department could save money and improve the service by doing so. Yet it is realized that the automobile has not yet passed beyond its experimental stage. Whether it would withstand the steady work entailed on the horses and wagons used by the Department remains to be seen, and while the Department is willing to co-operate with the manufacturers in testing the value of the vehicles for postal purposes, it will go slow on ordering them for the use of the Department. The Department may, however, give the manufacturers an opportunity to make experiments of their own, by placing machines in various cities at the disposal of letter carriers for trial trips. What is needed in the line of automobiles for this purpose is one which will permit the carrier to pass in and out of it without difficulty and which is easily managed and which can be operated at a small cost.

Automobiles in Berlin.

The electric droschkes on the Berlin street have been a great success, the new motor-cars completely distancing the old "hippomobiles," as a witty Frenchman described a cab, in the favor of the public. During the coming automobile exhibition a special cabstand will be reserved for the motor droschkes.

The Energy of Carbon—IV.

By C. J. Reed.

(Concluded.)

In considering from a commercial standpoint the process discussed in the preceding article, we must also take into account the fact that it can not be carried out without a simultaneous transformation of a large quantity of energy which is not derived from carbon, but from zinc oxide, a much more expensive substance. The transformation of 14,295 calories of carbon-energy requires the simultaneous transformation of 10,330 calories of zinc-oxide energy. And in the final electro-chemical reaction the zinc-oxide energy becomes unavailable in the liberated hydrogen in the same proportion as the carbon-energy. This means that, to obtain from carbon by this process the amount of electrical energy equivalent to the heat energy of one pound of carbon, we must oxidize 338 pounds of carbon in reducing zinc and convert 63 pounds of zinc oxide and 76 pounds of sulphuric acid into zinc sulphate. All of this material must be balanced against 5 pounds of carbon, which with a gas engine and dynamo could be made to develop the same electrical energy. The losses mentioned above are not the only losses incident to the practical working of the process. They are generally more than doubled by the waste of zinc and acid due to incomplete consumption and local action while not in use.

The efficiency of this process of transformation by means of zinc may be slightly improved by employing a different electro-chemical reaction.

If, to the galvanic cell, consisting of zinc, carbon and dilute sulphuric acid, we add in contact with the carbon plate, where it may undergo electro-chemical reaction, a substance capable of total or partial reduction with an absorption of less energy than that required for the reduction of hydrogen, the efficiency of the cell is increased, because less electrical energy is taken from the circuit to perform this reduction.

A suitable substance for this purpose is found in copper sulphate and other compounds of copper. With the addition of copper sulphate at the carbon terminal of the electrolyte the electro-chemical change is entirely different. The electrolytic oxidation of 32.5 grams of zinc no longer reduces any free hydrogen, but 31.5 grams of metallic copper. The freeing of this copper requires only 27,980 calories of chemical energy, instead of the 33,908 that would be required by the reduction of one gram of hydrogen. It is undoubtedly on this account that the copper is reduced more easily than the hydrogen and that no hydrogen can reduce so long as there is sufficient copper sulphate at the terminal of the electrolyte to transmit the electric current. The electro-chemical reaction is represented in the usual manner as follows:

$$Zn + H_2SO_4 + CuSO_4 = ZnSO_4 + Cu + H_2SO_4,$$

the amount of H_2SO_4 being the same at the beginning and end of the reaction. This allows a possible efficiency of $\frac{53{,}045-27{,}980}{53{,}045} = 47.3$ per cent. in the transformation of the total energy of the zinc into electrical energy, and $0.295 \times 0.473 = 0.14$ as the maximum theoretical net efficiency of transformation of the original energy of the carbon, while the actual efficiency attainable in practice cannot exceed $.0082 \times 0.473 = .00388$. The electromotive force resulting from this reaction is found as before, that due to the zinc being 2.28 volts volts, the counter-electromotive force of the copper being $\frac{27{,}980}{23{,}240} = 1.20$ volts, and the resultant electromotive force of the cell, 2.28—1.20 = 1.08 volts. This calculation is also in exact agreement with observation. It should be stated that the energy of the reaction, and consequently the electromotive force, varies to a small extent with the concentration of the solutions, but only to an extent corresponding to the energy absorbed or evolved by the solutions in passing from one density to another.

Instead of the copper sulphate we may employ as a depolarizing or oxidizing agent, a substance still more easily reduced than compounds of either hydrogen or copper, and thus obtain a still higher efficiency and electromotive force. It is in this step of the process that we may take advantage of such powerful oxidizing agents as the higher oxides of nitrogen, hydrogen, chlorine, lead and other oxides having low or negative formation heats and capable of undergoing reductions which not only absorb no energy, but evolve a considerable amount. With such reagents we obtain an apparent efficiency exceeding 100 per cent. of the carbon-energy of the zinc, being 100 per cent. of the carbon-energy increased by 100 per cent. of the heat-energy of the zinc, 100 per cent. of the zinc-oxide energy and 100 per cent. of the energy evolved by the oxidizing agent.

An illustration of this kind is found in the Bunsen cell, in which nitric acid, HNO_3, is the oxidizing agent. In such cells it is customary and advantageous to mechanically separate the oxidizing agent from contact with the zinc by a porous partition. We then have a chain or series of two electrolytes, one in contact with the carbon and one in contact with the zinc. Eonomy requires this separation in any cell having two electrolytes, whether the oxidizing agent be nitric acid or any other substance. With a slow rate of discharge or low current density and a low temperature the HNO_3 of the Bunsen cell is reduced to ammonium nitrate, NH_4NO_3, the electro-chemical reaction being represented,

$$4Zn + 2HNO_3 + 4H_2SO_4 = 4ZnSO_4 + 3H_2O + NH_4NO_3.$$

In this reaction our unit of 32.5 grams of zinc reduces 15.75 grams of HNO_3 and forms 10 grams of NH_4NO_3, which, instead of absorbing energy, evolves 630 calories. Instead of a counter-electromotive force at the carbon terminal, we have an electromotive force of $\frac{630}{23{,}240} = .027$ volt, which, added to the 2.28 volts produced at the zinc terminal, gives 2.31 volts as the total electromotive force of the Bunsen cell working under the conditions stated, and agreeing closely with the highest observed experimentally. The total available energy of this cell is $53{,}045 + 630 = 53{,}675$ calories, but only 14,295, or 26.6 per cent., came from the carbon without passing through the form of heat. The original energy of the zinc oxide amounts to 10,330 calories of 19.2 per cent. that absorbed from the furnace in the form of heat, 28,420 calories or 53 per cent. and that supplied by the nitric acid, 630 calories or 1.2 per cent.

The maximum theoretical net efficiency of transformation of the energy of carbon by this means is .295, but the maximum attainable in practice is .0082.

If, instead of a low temperature and a low current density, we employ a high temperature and a high current density, the reaction in the Bunsen cell results in the reduction of nitric acid to nitric oxide instead of ammonium nitrate, the reaction being,

$$3Zn + 2HNO_3 + 3H_2SO_4 = 3ZnSO_4 + 2NO + 4H_2O.$$

Under these circumstances 32.5 grams of zinc reduce 21 grams of HNO_3, liberating 10 grams of NO as a gas, which, on escaping into the air, forms the irritating "fumes" of nitrogen peroxide, NO_2. This change from HNO_3 to NO, instead of liberating 630 calories, absorbs 21,028, and the efficiency of transformation of the energy of the zinc, instead of being 100 per cent., is only $\frac{53{,}045-21{,}028}{53{,}045} = .604$. The maximum theoretical net efficiency of transformation of the energy of the carbon is $.295 \times .604 = .178$ and the maximum attainable in practice with present methods of reducing zinc, $.0082 \times .604 = .00495$ or half of 1 per cent. The counter-electromotive force due to the reduction of HNO_3 to NO is $\frac{21{,}028}{23{,}240} = .905$ volt and the resultant electromotive force of the cell is 2.28— .905 = 1.385 volts. This accounts for the great variations in the electromotive force of this cell and the difficulty of getting good and economical results from it when the proper conditions are not maintained. On the other hand, the employment of nitrous acid, HNO_2, instead of nitric acid, may under favorable conditions yield ammonium nitrite, NH_4NO_2, the reaction being

$$3Zn + 2HNO_2 + 3H_2SO_4 = 3ZnSO_4 + 2H_2O + NH_4NO_2.$$

In this reaction the 32.5 grams of zinc reduce 15.7 grams of HNO_2 to 10.7 grams of NH_4NO_2, and liberate 568 calories, making the formation. with these particular compounds is consequently zero efficiencies the same as with nitric acid used under favorable conditions. The electromotive force due to the reduction of the HNO_2 is $\frac{568}{23{,}240} = .024$ volt and the total electromotive force of the cell, 2.28 + .024 = 2.30 volts.

By using peroxide of lead, PbO_2, as the oxidizing agent we obtain the following reaction,

$$PbO_2 + Zn + 2H_2SO_4 = PbSO_4 + ZnSO_4 + 2H_2O.$$

In this reaction the 32.5 grams of zinc reduce 119 grams of lead peroxide, which forms 151 grams of lead sulphate, $PbSO_4$. The reduction of the peroxide absorbs 6070 calories and the combination of the lead and sulphuric acid to form lead sulphate evolves 11,750 calories, the resultant action at the peroxide terminal evolving 11,750—6,070 = 5,680 calories. This gives an electromotive force at this terminal of $\frac{5,680}{23,240} = .244$ volt, which, added to the electromotive force of the zinc terminal, 2.28, gives a total of 2.52 volts, with the efficiencies again at a maximum.

Finally, let us assume that the oxidizing agent is hydrogen peroxide, H_2O_2, a substance not found in nature, but which may be prepared artificially by an expensive process. It is one of the most powerful oxidizing agents and in decomposing it gives up a large quantity of energy. The electrochemical reaction now becomes

$$Zn + H_2O_2 + H_2SO_4 = ZnSO_4 + 2H_2O,$$

in which 32.5 grams of zinc reduce 17 grams of H_2O_2 to H_2O, evolving 11,535 calories and giving at the peroxide terminal an electromotive force of $\frac{11,535}{23,240} = .496$-volt, which, added to that of the zinc terminal, 2.28, makes the total electromotive force of the cell 2.78 volts. These calculations also agree exactly with experience, as shown in the lead-zinc accumulator, which consists of zinc, lead peroxide, dilute sulphuric acid and zinc sulphate. If such an accumulator, having a very strong solution, be thoroughly charged with a current of great density, some persulphuric acid is always formed, which decomposes immediately and forms hydrogen peroxide in small quantities. Such an accumulator, immediately after charging under the conditions mentioned, almost invariably has an electromotive force of 2.76 volts. On standing a short time or on being partly discharged, the H_2O_2 is destroyed and the electromotive force drops to 2.52 volts, corresponding to that of the zinc and lead peroxide. Hydrogen peroxide is rapidly destroyed in contact with lead peroxide and for this reason the high electromotive force of freshly charged lead accumulators or lead-zinc accumulators cannot be maintained.

We might multiply illustrations of this kind indefinitely, but the details of these indirect processes of obtaining electrical energy from carbon are merely the details of primary galvanic batteries. A primary battery has not generally been recognized as an apparatus for transforming the energy of carbon, probably because in it the operation is not a complete cycle, the apparatus itself being destroyed and the material thrown away, instead of being brought back to its initial condition. The practical reason for this that the complete cycle of changes is more expensive than new material.

The primary battery is, therefore, an apparatus for transforming matter as well as energy. In transforming a small amount of the energy of carbon into electrical energy, it incidentally transforms a much greater quantity of heat and energy from other sources into electrical energy, and at the same time transforms zinc ores and native sulphur into zinc sulphate.

We have seen that it is practically possible to transform the energy of carbon into electrical energy by means of zinc with an efficiency a little less than 1 per cent, but when we consider the value of the labor required and the materials incidentally destroyed, we find that the low efficiency is the least of the objections to the method. Comparing the efficiency and economy, both practical and theoretical, of these processes, viewed from their most favorable standpoint, with the efficiency and economy of heat engines of the commonest type, we find the advantage greatly on the side of the engine.

It does not necessarily follow, because the numerous indirect processes for transforming the energy of carbon by means of zinc or of any other particular metal are very low in efficiency and economy, that the same would be true of all other substances. The field for new discovery in this direction, however, seems to be limited to a very few of the most abundant and available of the elements now known, and a diligent search, conducted by the ablest scientists of the world for nearly a century, has failed to reveal any substance that, for operations on a large scale, is as efficient, available and economical as zinc for transforming the energy of carbon into electrical energy by electro-chemical processes. Whatever element or substance may be discovered to replace zinc for this purpose, we may be sure of one thing, namely, that the final efficiency of transformation by the use of any of the oxidizing agents enumerated above can not exceed the efficiency calculated for the hypothetical "direct" electro-chemical reaction.

Nevertheless, the search for a better substance than zinc is a legitimate field for research and is more likely to be rewarded than the chasing of deceptive *volts* of direct processes, which we have seen are practically, if not theoretically, impossible. The "*element of the future*," instead of supplanting the engine and dynamo, as has been predicted, seems more likely to be an accumulator supplied by an engine and dynamo.

On the Predetermination of the Regulation in Alternating-Current Transformers.

BY A. E. KENNELLY.

Computations connected with transformers are simplified by reducing the secondary circuit of the transformer to an equivalent secondary circuit with a ratio of transformation of unity, or, in other words, reducing either a step-up or a step-down transformer to the ideal condition of a level transformer. If n is the ratio of transformation (theoretically the ratio of secondary to primary terminal pressure at no load, and practically the ratio of secondary to primary turns) then all secondary pressures must be divided by n, all secondary currents multiplied by n, and all secondary resistances, reactances or impedances, divided by n^2. In the case of a level transformer, we know that we may assume the secondary circuit to be conductively connected with the primary, as represented in Fig. 1, where

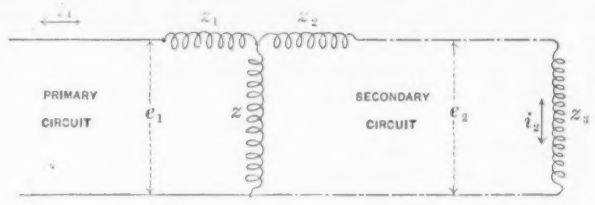


FIG. 1.

Z_1 = the impedance of the primary coil in ohms,
Z = the impedance of the exciting circuit in ohms,
Z_2 = the impedance of the secondary coil in ohms,
Z_3 = the external secondary circuit impedance in ohms.

At no load, the ratio of the secondary terminal pressuse e_2, to the primary pressure e_1, will represent the drop ratio under load, and will be

$$\frac{e_2}{e_1} = \frac{Z_3}{Z_1 + Z_2 + Z_3} \qquad (1)$$

if, as is generally the case, the impedance Z is so large relatively to the other impedances that we may safely ignore its effects.

Z_3 is always determinable from the conditions of load.

In order to determine $Z_1 + Z_2$ we make $Z_3 = 0$; that is, short circuit the secondary coil through an ammeter and measure the pressure e_1, which will produce any given current i_2 through the short-circuited secondary. Then

$$i_2 = \frac{e_1}{Z_1 + Z_2} \text{ and } Z_1 + Z_2 = \frac{e_1}{i_2} \text{ ohms.} \qquad (2)$$

From this, knowing the sum of the resistances $(r_1 + r_2)$, we can immediately determine the sum of the reactances $j(x_1 + x_2)$. Equation (1) will then give the drop ratio or regulation ratio under any given load Z_3, referred to a level transformer.

As an example, we may consider the following case:

A 500-kw transformer has a primary pressure of 2300 volts and a secondary pressure of 25,050. $n = 10.89$. Its primary resistance is 0.038 ohms hot, and its secondary coil 4.3 ohms hot.

$$Z_1 = 0.038 + j\,x_1 \qquad Z_2 = \frac{4.3}{(10.89)^2} + j\,x_2 = 0.03626 + j\,x_2$$

$Z_1 + Z_2 = 0.0743 + j(x_1 + x_2)$ ohms with the transformer assumed level.

With the secondary short-circuited, a secondary current of 217.4 amperes is obtained by a primary pressure of 384.7 volts (referred to a level transformer).

$$Z_1 + Z_2 = \frac{284.7}{217.4} = 1.31 = 0.0743 + j(x_1 + x_2)$$

$$\therefore Z_1 + Z_2 = 0.0743 + j\,1.308 = 1.31 \angle 86° 42'.$$

The drop ratio of the transformer on the full, non-inductive load of 10.26 ohms is by equation (1).

$$\frac{10.26}{0.0743 + j\,1.308 + 10.26} = \frac{10.26}{10.416} = 0.985$$

or a regulation of 1.5 per cent. between no load and full load. This will apply equally to the actual or to the level transformer.

If it should be desired to take into account the effect of the impedance Z, we first compute Z from the observed no-load primary pressure e_1, current i_1, and power p_1.

$$\text{Then } Z = \frac{e_1}{i_1} \angle \cos^{-1} \frac{p_1}{e_1 i_1} \text{ ohms.}$$

The complete formula then becomes

$$\frac{e_2}{e_1} = \frac{Z_2}{Z_1 + Z_2 + Z_3 + Z_1\left(\frac{Z_2 + Z_3}{Z}\right)}$$

The difference between the drop ratio corrected and uncorrected for the leakage through Z is, under ordinary circumstances, too small to be worth the extra labor of computation. The complete formula also requires the values of Z_1 and Z_2 to be ascertained separately. They are usually nearly the same, but their precise separate measurement is a matter of some practical difficulty. It is generally sufficient to assume that $\frac{x_2}{x_1} = \frac{r_2}{r_1} = \frac{Z_2}{Z_1}$.

The conclusion to be drawn from the formulæ is that the complete behavior of a transformer, under any given conditions of primary pressure and secondary load, may be predicted with all desired precision when the three transformer impedances Z_1, Z_2 and Z have been found for it. The sum of the two first is readily found by measurements with the secondary coil short-circuited, and the last is readily found by measurement with the secondary coil open-circuited.

A Frequency Indicator.

BY GEORGE J. YUNDT.

In the fall of 1898, while studying alternating current under Professor J. P. Jackson at The Pennsylvania State College, the writer had an experience almost similar to that given by Mr. Huber in his article on "Frequency Indicators," which appeared in the ELECTRICAL WORLD AND ENGINEER of Aug. 5. As many of the laboratory investigations required that the frequency be constantly known, some device was sought capable of giving accurately its instantaneous value.

Of the several schemes that presented themselves none proved desirable until the idea was hit upon of using the repulsive effect of a magnetic field upon a live conductor perpendicular to it; the length and tension of the conductor being varied so as to give it the same period as that of the current traversing it. This is the very same principle mentioned by Mr. Huber as an old one, though

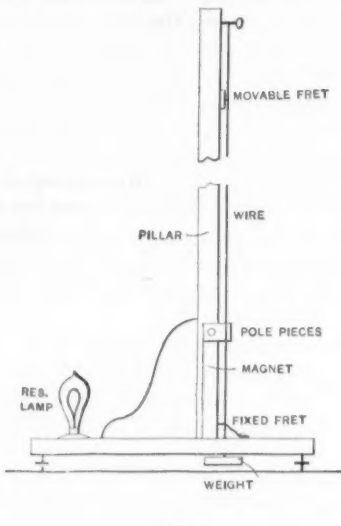


FIG. 1.

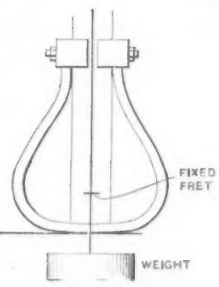


FIG. 2.

to the writer it was new at the time. After a few preliminary experiments an indicator was built with the assistance of Mr. H. P. Wood, a fellow student, as follows:

On a stout base board, supplied with leveling screws, was erected a wooden pillar about 40 inches long, and embraced at the bottom by a horseshoe magnet eight inches long. The magnet was provided with soft iron shoes one inch by an eighth, and so bent as to form an air gap in front of the pillar, one inch long and an eighth inch across. In this gap was streached a No. 26 phosphor bronze wire, secured at the top to a violin peg and extending along the face of the pillar to beneath the base board, where a weight was attached to secure the necessary tension.

By this arrangement all pulleys, levers and knife edges were dispensed with and the tension accurately maintained. As a definite point for determining the length of the vibrating segment, there was securely fixed, six inches below the magnet gap, a brass edge against which the wire was clamped after being put under tension. The other point determining the length of the segment was a movable fret playing over a scale attached to the front of the pillar. The range of the scale was quite extended, indicating frequencies from 100 to 130.

To regulate the current flowing through the wire two 16-cp 110-

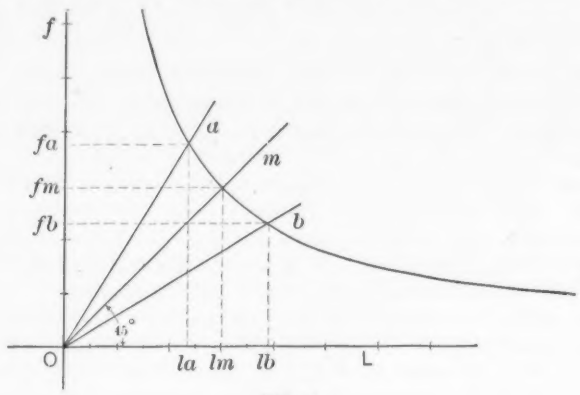


FIG. 3.

volt lamps were used, and so connected through a switch that they could be thrown in, singly, in parallel or in series. As the voltage ranged from 50 to 150 it was necessary to cut down the current as much as possible in order to distinguish between the fundamentals and the harmonies of both the wire and the current curve. The octaves below and above would always respond, though somewhat weaker than the principal period.

In designing the instrument the length and tension of the wire were calculated according to the formula:

$$n = \frac{1}{2l}\sqrt{\frac{P}{W}} \quad (1$$

in a slightly rearranged form. For any given wire and tension $\frac{1}{2}\sqrt{\frac{P}{W}}$ becomes a constant for all frequencies; therefore we have

$$n = \frac{1}{l} C \text{ or } n\,l = C \quad (2$$

which is the equation of the equilateral hyperbola. Plotting such a curve and using for co-ordinates length and frequency, we find that there is a portion of the curve which will form the most desirable part of the scale and giving the best readings. This will be, as shown in Fig. 3, that part lying between a and b, an angular distance of about 20° on each side of the line $O\,M$, at 45° to $O\,L$. Suppose in designing we should have required as our mean frequency 60, and chosen such a tension as to require a wire 60-cm long; then fm would equal 60, and zm would equal 60, or fm would lie on the curve at the point m, the most desirable position. The range of such an instrument would be above and below this point, say to fa and fb, giving long this la and lb, care being taken that lb is less than twice la to avoid the confusion of frequencies slightly below fb and above fa with those on the scale, which confusion is caused by the strong respondence of the octaves.

Having chosen the mean frequency and length, the other points are rapidly calculated for, since $n\,l = C$ or, in the present case, equals 3600, any other length on the scale may be found by dividing 3600 by the corresponding frequency. In dealing with high frequencies, such as 150 or more, it is best to choose the wire length by substituting for P in formula (1) the safe load that the wire will carry. In such a case, if centimetres be used, fm will equal, in numerical value, two or three times lm, resulting in smaller spaces for each frequency.

The best wire to use is phosphor bronze; steel and iron are almost useless as their magnetic qualities introduce a disturbing effect.

The appearance of beats was also noticed when near the point of synchronization, and an investigation revealed that they were due to the lacing of the belt, which caused a slight angular acceleration at uniform periods, resulting in beats. This probably shows better than anything else the sensitiveness of the instrument.

Meeting of the American Association for the Advancement of Science.

THE American Association for the Advancement of Science met in Columbus Aug. 21 to 26, in the most successful session it has ever held in a city of the Middle States. Not only was this true from point of number of those in attendance, but the quality of the papers presented before the different sections this year was above the average; and in both technical and popular interest, and in a directly practical sense, generally speaking, exceeded in value even those that were read and discussed at the Boston Jubilee meeting of the American Association last year.

Opening with a rather sparse attendance of actual members, it turned out that papers of more than ordinary interest were announced and presented from time to time, and before the end of the week the meeting had rounded out into excellent shape.

A preliminary meeting of the council was held in the Chittenden Hotel on Saturday evening, Aug. 19, to pass upon the programme for the ensuing week, and to discuss amendments. At this session thirty new members were elected, five being from New York City.

Promptly at 10 o'clock on Monday morning retiring President Frederick W. Putnam called to order the first general session of the association in the chapel hall of Ohio State University. Adjutant General Axline welcomed the assembled scholars in the name of the State, and Judge M. B. Earnnart addressed them in behalf of the city, followed by Dr. William O. Thompson, representing the university. President Putnam then introduced President-elect Edward Orton and the auditorium rang with round after round of applause as that aged and distinguished Ohio educator rose to assume the honor conferred upon him. Dr. Orton replied to the addresses that had preceded him, and opened the meeting with a review of the progress of science and its effect upon civilization since the human race "first found itself." He looked back so comprehensively and with such a clear mental vision from the closing year of the present century, and compare l the nineteenth century with all past time so ably that much of the final success of the meeting is attributable to his masterly address. White haired and trembling with age, after fifty years of devotion to the progress of human knowledge, yet preserving all those graces that fit him to preside over a deliberative body, the effect of his presence on that occasion was impressive. His language was so simple and well chosen that it would be hard to find a twelve-year-old boy who would not have listened to and understood perfectly what he had to say. Dr. Orton said that the next century seemed destined to show the rounding out of medicine into an exact science; a better knowledge and use of the laws of energy; a nearly perfect understanding of the phenomena of electricity and magnetism; and some comprehension of the mystery of life itself. What is needed to-day in science are builders as well as analysts, for the most useful truths are the great ones, and the new ones destined to be discovered will be arrived at by putting together some of the dry technical facts of which science is full to-day. He said in part:

"Our contributions to science are often fragmentary and devoid of special interest to the outside world. It is possible that we could make ourselves more interesting to the general public if we occasionally foreswore our reserve and spent a portion of our time in restating established truths. We do not always know the real significance of what we have in hand. A fact or an observation that we may put on record here may have in reality a different significance than the one we are disposed to give it, and consequently may have far more importance than we recognize. But every fact has a place in the great temple of knowledge, and the wise master builders, some of whom appear in every generation, will find them and use them all, and then only will their true value come to light. The field which is the world was never so white to the harvest as it is now, but it is still early moving on the dial of science."

After President Orton's address the association divided into sections as scheduled, in order to facilitate special work in each of the various departments of science. There were nine vice-presidential addresses, each before its respective section, and that of Elihu Thomson will be printed later. The railroads about Columbus and the trolley lines in the city deserve some special mention for their admirable handling of the convention. During the week no less than three trunk lines arranged complimentary excursions to various points of scientific interest in the State of Ohio for members of the association.

Three minor constitutional amendments were adopted by the association this year, one of which allows any qualified person to become an associate member with privileges for a year, upon payment of three dollars into the treasury.

On Friday, Aug. 24, the council met and elected Prof. C. M. Woodward, of Columbia University, president, to succeed Dr. Orton at the 1900 meeting, which was voted to be held in New York City.

Out of the 273 papers read during the week, there were a large number on electrical subjects. Owing to the lack of management which has almost constantly characterized the meetings of the association, few of these were available for the press. Such abstracts of the electrical papers as it was possible to obtain after strenuous effort are printed below. Should they become available, abstracts of the other papers on electrical subjects will be printed in future issues.

AN APPARATUS FOR THE DEMONSTRATION OF THE VARYING CURRENTS IN THE DIFFERENT CONDUCTORS OF A ROTARY CONVERTER.—By Prof. F. C. Caldwell, Ohio State University.

This apparatus consists of (a) a disk of paper board, having a narrow slit cut along a radius, and occupying nearly the whole of the latter, on the edge of which slit is a scale of plus and minus amperes, with the zero at the middle. (b) A paper disk, placed under disk (a) and marked with a datum circle under the zero of current, and a sine curve drawn with radial ordinates, its maximum being equal to the maximum alternating current supplied to the converter. Also two lines parallel to the sine curve, and radially distant therefrom by the amount of the direct current. (c) A back of paper board, upon which are represented two pole-pieces and two brushes, and upon a pivot in the center of which disk (a) and (b) turn. (d) Strips representing collector ring connection being so placed, and the disk (b) being so attached to the back that the maximum of the sine-curve will come under the slit when the section of the armature disk (a) including the slit is under the center of the pole-piece, by revolving disk (a) the ordinate cut off by the slit from one or the other of the lines parallel to the sine curve will give instantaneous current in the conductor represented by the slit. The different current curves in the conductors differently situated with reference to the collector connections may be studied by changing the points of attachment of the latter relatively to the slit. Other phenomena may also be studied.

A NEW FORM OF ELECTRICAL CONDENSER HAVING A CAPACITY CAPABLE OF CONTINUOUS ADJUSTMENT.—By Lyman J. Briggs, Physicist, U. S. Department of Agriculture.

This condenser consists of a stack of spring brass and mica sheets, arranged in the usual manner. The spring brass plates are given a curved form, so as to present an open structure when the condenser is assembled. The capacity of the condenser can consequently be continuously varied by compressing the system of plates. The condenser can be used either in air or oil.

CURRENT AND VOLTAGE CURVES IN MAGNETICALLY BLOWN ARC AND IN ALUMINUM ELECTROLYTIC CELL.—By Prof R. A. Fessenden, Western University of Pennsylvania.

Shows that placing an alternating current arc in a strong magnetic field makes the current wave flat-topped and increases the efficiency. Curves of voltage and current taken between different points in an aluminum cell shows that polarization not pure resistance effects, are due to the formation of $Al_2 O_3$, but that change of phase absolutely takes place as film acts as dielectric of condenser. Efficiency low.

ELECTRICAL ANAESTHESIA.—By Dr. E. W. Scripture, Yale.

A method is described of producing anæsthesia—or rather analgesia—by direct application of an electric current and without either internal or local application of drugs, and based on the following principles:

An alternating current—preferably a sinusoid—with equal positive and negative phases is made to traverse the nerve. At a proper frequency—about five thousand complete periods in a second—it can be made to cut off all sensory communication by this nerve. Needles can be run into the part of the body supplied by the nerve without any pain being felt.

Groups of nerves, e. g., the brachial plexus, can be cut off from communication in a similar manner. Experiments are now being made in the effort to get at the root of the spinal nerves, and thus it will cut off communication with the various parts of the body.

Experiments have been tried in sending the current from the Casserian ganglion through the superior maxillary nerve with a view to cutting the teeth from communication, but the contraction of the facial muscles have proved as yet too disturbing.

The experiments have made evident the fact that with increasing frequency of alternation the muscular contractions decrease; it is proposed to raise the frequency still higher to avoid muscular contractions while retaining the analgesic effect—a machine for this purpose being now under construction.

CONCERNING THE FALL OF POTENTIAL AT THE ANODE IN A GEISLER TUBE.—By Prof. Clarence A. Skinner, University of Nebraska.

Observations were made with a Geisler tube, cylindrical in form (length 20 cm., diam. 4 cm.), provided with disc electrodes (diam. about 2 cm.). The results given below were obtained in nitrogen gas (pressure 3 to 6 mm.) through which a constant electric current from a storage battery of 600 cells was passed.

The fall of potential at the anode was measured by a quadrant electrometer as the difference of potential between the anode and a movable platinum wire which could be approached to contact with the anode. So far as it can be proven by this method, the fall of potential at the anode is of the nature of a sudden drop between electricity and gas. In the immediate neighborhood of the anode the gas is a perfect conductor, the potential gradient is zero. The space of perfect conduction may extend about 2 mm from the anode, but its extent decreases rapidly with increasing gas pressure. Outside the potential gradient the potential gradient rises more or less rapidly to a constant value throughout the unstriated positive column, or luminosity. The fall of potential at the anode is: (a) independent of the current density, be the gas pure or impure, the anode clean or tarnished; (b) increases slowly with increasing gas pressure; (c) increases rapidly as the anode becomes tarnished; (d) is sensibly influenced by impurities in the gas; (e) for all metals with polished surface tested, lies between 18 and 35 volts at 1 mm. gas pressure; whereby of the metals the one which has the smaller fall of potential at cathode shows greater at anode. Further, it was found that the greater the fall of potential at the anode, the greater the distance from the anode in which the gas was rendered a perfect conductor, and also the slower the potential gradient outside this space rose to its constant value for the positive column.

ON THE NATURE OF ELECTRICITY AND MAGNETISM, AND A DETERMINATION OF THE DENSITY AND ELASTICITY OF THE ETHER.—By Prof. A. Fessenden, Western University of Pennsylvania.

Fourier's idea of dimensions as shown by his definitions was explained and it was pointed out how these have been departed from by later authors in suppressing dimensions, thus making the formulæ merely a question of units. It was shown how Fourier's ideas may be applied to the problem of the solution of the nature of electricity. All electrical phenomena whose laws can be formulated in relation to mechanical quantities are contained in the following three equations:

$$1 - q/b :: k/u$$
$$2 - k\,u :: T/L$$
$$3 - q\,b :: ML/T$$
$$4 - q\,u :: Z$$

Having but three equations and four unknown quantities (q : : quantity of electricity, b : : quant. of magnetism, k : : specific inductive capacity and u : : magnetic permeability) we cannot directly solve. Putting, however, q equal to an unknown term Z, and gi, we may obtain all possible theories of electricity, including those already proposed by Lodge, Kelvin Heaviside and others. For example, if Z be put equal to LT, then k becomes a density, u the compliancy, etc., as given in one of Heaviside's theories. For the solution we must get a fourth equation.

A sketch of work extending over a number of years in search for this fourth equation and its discovery found in the relation between velocity of sound and electric conductivity; other relations were discovered, but none giving a new equation.

Williamson's proof that either k or u must be a density. This proof incomplete. Proof made complete and same results obtained by two other methods. How to decide which is the density.

We have relations between q and b, and k and u; we must therefore look for relation between q and u, or b and k, i. e., between H and u and v and k. This leads us to the above conclusion through the above three equations.

1. "Either k varies inversely with v, or u with H."

2. "The coefficient which varies inversely with the corresponding intensity is a compliancy."

This gives a touchstone for detecting which of the two theories is correct. It is then shown that k does not vary inversely with v, but that u does with H. Therefore k is a density and u a compliancy. Part 2 of the paper contains additional proof. Shows that the effects of stress, permanent strain, change of composition and elastic properties all agree with this theory and give the results predicted by it. It is shown that all magnetic properties of iron can be expressed by two coefficients, and it is shown that the hysteresis coefficient is equal to one of these multiplied by a constant.

It is also shown that there is a single relation between the density of substances and their specific inductive capacity, and that we are thus enabled to determine the density of the ether. This is done. It is also shown that the variation of density with temperature and with change of state follows this theory.

Part 3 contains an account of the experiments made to establish the relation between H and u and of the precautions taken to avoid error. Curves are given showing results.

THE DIELECTRIC STRENGTH OF OILS.—By Prof. Thomas Gray, Rose Polytechnic Institute.

At last meeting of this association the author presented an account of some experiments on the dielectric strength of insulating substances, in which the results for oils were somewhat uncertain, and it had been found difficult to form any very decided opinion as to whether the dielectric strength of a layer of oil is or is not proportional to the thickness of the layer. During the past spring Mr. C. E. Keyes, a member of the graduating class at the Rose Polytechnic Institute, continued the experiments on oil. Mr. Keyes directed his attention largely to the questions of proportionality of strength to thickness and the effect of filtering through drying materials like calcium chloride. The difficulties experienced last year, due to the variations of the dielectric strength under continued electric stress, were again met with. It was found that filtering through chloride of calcium or leaving the oil for a day or two mixed with that substance did not remove the trouble and almost always reduced the strength considerably. By making a large number of measurements in cycles of varying thickness of layer and then averaging the results, considerable evidence was accumulated which went to show that the dielectric strength per centimeter thickness is greater the thinner the layer tested. Oil seems therefore to agree with gases and most solids in this respect. The author stated that the subject is not by any means closed, but he gave a few of the average results as an indication of the evidence obtained. The absolute value of the dielectric strength is largely a function of the length of time during which the oil has been subjected to electric stress. A considerable number of oils were tested, and many of the samples gave results of a very erratic character. It seems probable that there is a gradual change in the dielectric properties of these liquids while under stress. Possibly the whole difficulty is due to a species of polarization which may be most marked close to the place.

In the following table the numbers in the headings are the thickness of the layers tested; the first column contains the name of the oil, and the numbers in the body of the table are the dielectric strengths in kilvolts per centimeter:

Kind of Oil.	1	2	3	4	5	6	7	8	9	10
Vaseline.....	131	120	109	103	105	95	96	91	..	..
Paraffin, 28 G.....	91	81	76	71	73	70	69	70	72	..
Paraffin, 26 G.....	101	89	85	79	79	71	66	64	62	60
*N. W. V. C., 29 G..	81	79	74	72	69	62	63	62	60	..

*Natural West Virginia crude oil from 29-30 gravity.

POLARIZATION AND INTERNAL RESISTANCE OF COPPER VOLTAMETER.—By Prof. B. E. Woods, University of Nebraska, Lincoln, Neb.

The polarization of electrolytic cells by means of direct current is usually measured upon an independent circuit after the polarizing current is removed. The charge from the one circuit to the other cannot be made instantaneously and the polarization actually measured is less than the maximum. This has its effect upon the apparent internal resistance, r, which is calculated from the formula, $r = \frac{E - P}{i}$ where E, P and i are the applied electromotive force, polarization and current respectively. Values of r thus obtained decrease erroneously with increasing i. The experiments indicate that

this arises from a failure to measure the maximum of P. This is shown by measuring P at different time intervals after the removal of the current. The time intervals vary from .00006 to .045 of a second. The results indicate that constant resistance for all current strengths would probably be obtained if the polarization could be measured in zero time after the removal of the polarizing electromotive force. Measurements were made with the condenser and ballistic galvanometer and the circuits were manipulated by a swinging pendulum. The smallest time interval is very near the time required to charge the condenser through the apparent electrolytic resistance. Therefore shorter time intervals, though desirable, can hardly be obtained by the condenser method. However, greater accuracy in the determination of the shortest time interval is possible and desirable. The observations are limited to the copper voltameter with different size plates.

AN ABSOLUTE DETERMINATION OF THE E. M. F. OF A CLARK CELL.—By Prof. H. S. Carhart and K. E. Guthe, University of Michigan.

The paper gives an account of the continuation of experiments made with an absolute electrodynamometer for the determination of electrical units. While last year the electrochemical equivalent of silver was redetermined, this year by practically the same method the e. m. f. of the Clark standard cell was found. As a result of the measurements, $E = 1.4333$ volts at 15 degrees C.

THE EQUIPMENT AND FACILITIES OF THE OFFICE OF U. S. STANDARD WEIGHTS AND MEASUREMENTS FOR THE VERIFICATION OF ELECTRICAL STANDARDS AND MEASURING APPARATUS.—By Dr. Frank A. Wolff, Jr.

The paper briefly outlines the steps so far taken by the office of Standard Weights and Measures for the verification of electrical standards and measuring apparatus submitted by institutions, the trade and by individuals. A description is given of the preliminary standards of references adopted, the methods of comparison employed and the accuracy obtainable as shown by comparisons already made.

To fix the value of the preliminary standards of resistance pending the construction of a number of mercury units, frequent comparisons are to be made of the present standards with each other, with mercury copies, the construction of which is to be taken up immediately, and with new coils known to the highest degree of precision in terms of Reichs-Austalt mercury units, and therefore in terms of the B. A. coils.

The unit of electromotive force will similarly be fixed by a construction from time to time of new Clark and cadmium cells from specially purified materials by the frequent intercomparison of the old ones of each type with each other, and by the determination of the ratio from time to time of the Clark and cadmium cells of the office.

The object of the paper is mainly to announce to the public in general this enlargement of the scope of the work and its policy to guarantee the highest present attainable accuracy.

EFFECT OF MAGNETIZATION ON THE MODULUS OF ELASTICITY.—By Prof. J. S. Stevens, University of Maine.

It has already been found (Cornell Lab.) that temperate changes affect the modulus of electricity. This experiment tested the effect of magnetization. Steel and wrought iron bars 60 x 1 x 0.64 cm. were used and loads of 1-kg and ½-kg fastened to the centre. These caused a deflection. When the rods were magnetized by forces ranging from 19.9 to 126 c. g. s. units, the deflection was decreased, showing that magnetization increases the modulus.

The change in deflection was increased by an interferometer, one plate of which was fastened to the bar and the motion read in wavelengths of light. Temperature changes were guarded against—1. By a stream of water flowing between coil and rod. 2. By testing with a sensitive thermometer. 3. By noticing that the change in deflection was always sudden. 4. By discovering no change in a copper rod.

The measurements were not considered sufficiently exact to enable it to be stated that there is a regular relation between magnetic force and the modulus increased with the magnetizing force.

Exposure of a Criminal Institution.

We have before us a strange pamphlet, having the above title and signed with the plagiarized name of a well-known inventor, in which the charge is made that at the Bloomingdale Asylum, at White Plains, N. Y., the authorities make use of electric rays to "distress individuals and make them appear as insane. They make many of their own patients in this way, and they have their own confidence men outside to assist in the work and ignorant doctors send many to this place." The pamphlet in its preface gives a rambling account of invisible electric rays, and refers to a Smith telegraph which "projects rays through space so that they will be an inch only in width through the air." It is charged that this and other invisible electric ray apparatus are used for persecution at Bloomingdale, and the reader is told "if you hear whispering you cannot account for and cannot see the person who is doing the whispering, pay no attention to it. If your family cannot hear the whispering (and how can they when the voice comes, as explained by Smith, on an invisible current one inch wide), they will consider you insane." It is added that as the criminals who practice these arts on the insane only want money, they will not be apt to trouble one if he is poor. In carrying out their machinations, it is said that "some they do not whisper to except in so low a tone that the person will be apt to believe it to be his own thought, and these they put a stupefying current on to give them neuralgia and other distressing symptoms, and make them think that they (the patients) are very distinguished persons, kings, queens, counts, etc.; tell them that they have a peculiar mission in life; the patient is to be a prophet, a messenger from God; he is to be a savior of the world; go on some very religious mission, etc., etc. They work the patient according to his own taste and habits." The charge is also made that the same practices are resorted to in European institutions of like character. The name of the asylum is left blank in the text and filled in with a rubber stamp, and the signature is also imprinted with a rubber stamp at the end of the pamphlet.

New Power House of the New York Gas and Electric Light, Heat & Power Co.

The plans for the above new power house have been finally adopted this week. They are as follows: The power house will be located between 38th and 39th streets, fronting on First Avenue, with the rear on the East River, the area occupied being 200x276 feet.

The plans for the station include the following equipment: Sixteen vertical engines, each engine connected to a 3500-kw three-phase generator. The engines are to indicate approximately 5500-hp when running at best economy, and they will have a maximum capacity of at least 8000 indicated h. p. The total power of the engines when operating at best economy will be, therefore, 88,000-hp, with a maximum power of 128,000 indicated h. p.

The station will be equipped with fifty-six water tube boilers, each boiler having 6100 square feet of effective heating surface. It will be divided into two parts, with an east and west dividing wall between, separating the engine room from the boiler room, the north section comprising the boiler house and the south section the generating room. The boiler house will contain two decks of boilers, each boiler room having a height of approximately 30 ft. The third floor, over the second tier of boilers, will contain the coal bunkers having a combined capacity of over 9000 tons.

The smoke flues for the upper tier of boilers will be placed under the sloping sides of the bunkers. The iron framing under the coal bunkers will also support four steel smoke stacks 19 ft. in diameter, of approximately 132 ft. above the grates, or 200 ft. above the level of the ground. The stacks will be lined with brick on the sectional system, permitting of repair to any section without disturbing the other sections.

The basement under the boilers will contain the smoke flues for the lower tiers of boilers and the usual complement of pumps, blowers, tanks, etc. The ash tramway will be located in the basement with space also for economizers.

The engine room will occupy the main portion of the area covered, with space at the front end and at the south side for electrical apparatus, switchboards, offices, storerooms and shops. The basement under the engine room will contain the circulating pumps, piping and cable racks. A storage battery, as an auxiliary for supplying current to the exciting circuits, will be placed under the south gallery. Preliminary plans of the plant have already appeared in these pages.

CURRENT NEWS AND NOTES.

NEGUS MENELIK'S GREETING.—A phonograph was taken on Aug. 18 to Osborne House, the Queen's residence on the Isle of Wight, and when the machine was started it spoke friendly greetings to her Majesty which had been uttered by Negus Menelik. The Queen responded into a receiving phonograph, and her message will be taken to Abyssinia.

STREET RAILWAYS IN FRANKFORT.—Vice-Consul-General Hanauer writes from Frankfort, July 22, 1899, as follows: The total length of the street railway system in Frankfort at the end of the year 1897 was 18.9 miles. The gross receipts during that year were $632,000, of which $68,000 were paid to the city treasury, according to the contract. There were 781 horses and 197 cars in use, and 26,507,403 passengers were carried during the year. The net proceeds amounted to $102,457.

A CAMPAIGN AGAINST RECKLESS AUTOMOBILES IN PARIS.—There is a movement on foot in Paris to place private automobiles under more severe restrictions, which will include a lowering of the maximum of speed now allowed, and the forbidding of persons to run automobiles who do not possess certificates as to their knowledge and ability. In a single week eight or nine persons were killed and as many as fifty wounded through automobile accidents in or near Paris. In every case these accidents were owing to rapid traveling or to the ignorance of those conducting the machines.

TAXAMETER CABS IN LONDON.—A special cable despatch from London of August 19 says: The Cabmen's Trades Union has driven the taxameter cabs off the streets of London. When the Taxameter Company's three months' contract with their drivers expired none dared to re-engage, owing to boycotting by the union, and the cabs were perforce withdrawn, though the drivers of them aver that they earned more than union wages. The Taxameter Company is now buying cabs and starting a special school to train drivers of their own, promising to put 150 on the street within a month.

AUTOMOBILE AS WAR ENGINE.—A Cleveland despatch announces a test of the gas engine automobile as a war engine, the test consisting in carrying a message from Brigadier General Anderson, of Chicago, to Major General Merritt, of New York. It is stated that War Department officials are taking great interest in the trip. It is not announced, however, that precautions have been taken to guard against attempts of jealous telegraph and telephone men to bring disaster on the project. One of the names mentioned in connection with the trial is that of the automobilst who recently permitted himself to be so ingloriously bluffed by a clever Frenchman apropos of an international automobile race.

SAWING BY ELECTRICITY.—A despatch from Clinton, Ind., says: The old wagon bridge which has spanned the Wabash River at this point for half a century has been wrecked by electricity. The county had bought the piers from Dr. Bogart, the principal owner, he agreeing to remove the superstructure to make way for a new bridge. Efforts were made to burn the bridge, but as it was found that would injure the piers, the sills were wired and electricity was applied. The current was turned on at 5 o'clock in the morning, and at 2 o'clock in the afternoon the pile of timbers toppled into the river, leaving the foundations unhurt. The electricity had the effect of cutting all the sills simultaneously as with so many saws. Two thousand persons watched the operation.

THE GROUNDING OF THE HOOKER.—The board appointed to examine into the causes of the grounding of the United States cable ship Hooker, which recently went ashore near Corregidor Island, at the entrance of Manila Bay, as noted in these pages last week, finds that the accident occurred in daylight, on a reef shown on the chart, and that there were evidences of carelessness on the part of the navigator of the vessel. The cable instruments and other property have been removed from the Hooker, and the cable is now being removed. If no storm intervenes, hopes are entertained that the vessel may be hauled off and repaired. Her hull has been badly torn by the coral reef on which she struck. The former Spanish gunboat is engaged in the work of getting her afloat.

LIGHTING ST. PAUL'S CATHEDRAL.—The Dean and Chapter of St. Paul's Cathedral have concluded not to have the cathedral lighted by electricity at present. The expenses of the installation of the electric plant have been offered by Mr. J. Pierpont Morgan, but the authorities of St. Paul's fight shy of the electric light proposition. The redecoration of the cathedral, which is now progressing, also makes electric lighting an artistic impossibility for the present. The *Daily Chronicle* significantly says: "If it should eventually be decided to install electric light then there should be no difficulty in securing adequate funds in the ordinary way." There appears to be some prejudice or feeling on the subject due to the Hooley episode, when the Chapter declined the communion service offered by that speculative magnate.

TORPEDOES FIRED UNDER WATER.—For the first time since the Holland submarine torpedo boat was taken to Long Island a test of discharging torpedoes was made on Aug. 9. The trial took place over the Government course and Little Peconic Bay. Besides the torpedo test, the trials included sending the vessel over the course both submerged and awash. The trials were pronounced successful. The torpedo was fired when the boat was moving and about four feet below the surface. It was blown from the tube by air pressure and was taken in a straight line for about 75 feet. There was scarcely any disturbance in the water from the discharge of the torpedo, only a few air bubbles showing on the surface near the bow of the boat. The torpedoes used were dummies of the smaller Whitehead type. They weigh about 820 pounds each and have an explosive charge of 110 pounds of wet gun cotton.

REPORTING THE DREYFUS TRIAL.—The Atlantic cables have been heavily burdened with reports in extenso of the famous Dreyfus trial at Rennes. It cannot be said that the French press has not displayed enterprise this time. Every day the court martial has sat between five and six hundred thousand words have been sent from Rennes by telegraph. On the day of the attack upon Labori, this figure was surpassed, close upon seven hundred thousand words being wired. M. Chincholle, in the *Figaro* the other day, referred to the correspondent of an American paper who spends daily a couple of thousand francs, and then crows over him by pointing out that, so far as the clock goes, his million, more or less, of readers get the news before Chincholle's do. The work has been so hard upon the telegraphers that an additional contingent of fifteen operators has been sent to Rennes to lend a helping hand to the regiment already stationd there, and which is running some risk of breaking down under the unremitting strain upon its strength.

DEVELOPMENT OF INDEPENDENT TELEPHONY IN ST. LOUIS.—In a recent letter addressed to Mr. Chas. E. Adams, of Lowell, president of the Boston & New York Telephone Company, General Manager Hanford, of the Kinlock Telephone Company, of St. Louis, Mo., says: "We now have 4812 telephones in actual operation. Our rates are $36 per annum to residences and $60 to business places. The average of those now in operation above stated is $53.94 per annum; we have been in actual operation about five months. A month ago our maintenance and operating expenses including everything, rent, attorney's fees, salaries, etc., were $24.10 per instrument per annum; we have now succeeded in reducing the expenses to $22.10 per annum, and within 30 days the entire cost of operating and maintaining will be down to $20 per instrument per annum. We pay liberal salaries, and in fact every part of the business is operated on a fair and equitable basis. Our exchange has a capacity of 6140 instruments, but we are putting in an addition of 2600 additional instruments on account of the demand. We have several hundred contracts on file which we have been unable to furnish because our terminals are full, but the new extension will cover them. Our capital is $2,000,000 and our authorized bonded indebtedness is $2,000,000, of which $1,400,000 have been sold to the Mississippi Valley Trust Company for cash. At this early date we are able to pay the interest on the bonds and 4 per cent. on the capital, and within six months we shall be able to pay from 7 to 10 per cent. on the capital stock. We have sent out bills for six weeks' service, and up to this time four-fifths of our customers have paid; the next lot of bills will very likely be paid up almost entirely. We have the support of the public and the entire enterprise is a pronounced success."

LIGHTNING RIPENS GRAPES.—At St. Joseph, Mich., the presence of full-grown ripe Worden grapes upon the market for the past few weeks has been puzzling the oldest grape growers, who report that this particular variety of grapes was never heretofore ripe enough to market before Sept. 10. They account for the unusually early ripening as follows: About two weeks ago several large vineyards were struck by lightning, which leaped along entire rows over the wires which support the vines. Contrary to the growers' expectations, who thought all the vines would be ruined, the green fruit began to ripen immediately, and the vines were practically uninjured.

TELEPHONIC REPEATERS.—Mr. C. J. Glidden has written to the French paper *L'Illustration,* which called attention to his offers of $1,000,000 each for a telephone repeater and a telephone quadruplex, and confirms both. He says his own companies are operating 50,000 miles of long distance line. No. 8 copper telephone circuits now extend from Boston to Galveston, Texas, in the Southwest, a distance of about 2200 miles; Boston to Fargo, N. D., in the Northwest, a distance of about 1800 miles, and Boston to Omaha, in the West, a distance of about 1600 miles. Commercially speaking, the long distance service at present is limited to from 1500 to 1800 miles; hence the need of a telephone repeater.

OPERATING TORPEDOES BY LIGHT.—According to one of the popular magazines, a young Swede, Axel Orling, has discovered a method of transmitting motive power by rays of light, and has applied the method to the operation of torpedoes. The rays of light used by Orling are described by him as "an entirely new, powerful and penetrative form of X-rays." The following is the lucid explanation given of the system: "A torpedo to be governed by the new principle is fitted with an apparatus to receive the light rays sent out from the controlling station and transform them so far as to cause electrical induction, thus enabling the operator on ship or on shore to set the torpedo rudder at any angle that he desires. The rays also enable the detonating pistol to be fired when the operator decides that the psychological moment has arrived."

OXIDANT FOR ELECTRICAL BATTERIES.—In a patent granted Aug. 22 Leonard Paget, of New York, describes a method of manufacturing positive plates for storage batteries, which consists in placing the plate in an electrolyte containing as its essential element a peroxide of chlorine, a salt of magnesium and a solution of sulphuric acid. The plate is then made the anode for an electric current, there being a potential difference of about 3 volts between the anode and the cathode of lead. A suitable strength of current is ¼ to ½ ampere per square inch of the lead anode. The lead plate is converted into a coherent mass of lead oxide having 1.6 times the volume of the original lead and being of an intensely black coloration. By this means a storage battery positive plate is produced having throughout its entire mass the highest possible degree of oxidation.

MUNICIPAL OWNERSHIP DEBATE.—Arrangements have just been completed for a most comprehensive discussion of the municipal ownership question. It will occupy an entire day of the convention of the League of American Municipalities, to be held at Syracuse Sept. 19-22. The affirmative side of the question is to be presented in papers by Mayor Henry V. Johnson of Denver, Mayor Gustav Tafel of Cincinnati, Mayor Frank G. Pierce of Marshalltown, Ia., and Mayor J. R. Robinson of Colorado Springs, Col. Papers on the negative side will be read by Robert P. Porter, former Director of the Census; M. J. Francisco, a former president of the National Electric Light Association, and M. A. Gemunder, former Director of Public Works at Columbus, Ohio. Following the reading of these papers the convention will enter into a general discussion of municipal ownership, to be led on the affirmative side by Mayor John MacVicar, of Des Moines, and on the negative side by Henry L. Doherty, president of the Northwestern Electrical Association, and Allen Ripley Foote.

LIFE-SAVING DEVICE PRIZE.—The State Department is at work upon the circular to foreign governments concerning the Anthony Pollok memorial prize for the best invention of life-saving apparatus to be used on ships at sea. The jury of award will probably be a naval officer of the United States, a juror to be selected by the French government, the nation which is to entertain the other nations of the world at the exposition of 1900, where the prize will be awarded, and a third to be chosen jointly by these two. The representative of the United States, it is thought at the Navy Department, will be Lieut. William S. Sims, as he is the naval attaché to our embassy at Paris, and who will be on the ground. The prize will be $20,000, and it is understood that the privilege will be reserved of giving the whole sum to one inventor, or dividing it between four or five equally deserving, or if all offers are discarded, using it to compensate the disappointed inventors for their expenditure of time and money. Already letters from cranks of all sorts, the authors of supposed great inventions, are pouring into Washington in a flood.

SOME NEW ELECTRIC METERS.—Among the more interesting of the U. S. patents issued Aug. 22 are five on electric meters, three of which are on new forms of maximum-demand meters. A patent by Prof. Elihu Thomson describes a system of electric metering whereby the rate at which the meters register is controlled, independently of the speed of the motor mechanism, from the central station or any distant point. The usual form of meter is provided with two registering trains and dials. One of these trains may record continuously and the other is thrown in and out of circuit from the controlling point whenever desired. A normally idle wire extends from the controlling point to the meters which are to be controlled. When a current is sent through this wire a magnet is actuated and by means of a ratchet, motion is thus given to a cam which in turn engages or disengages the second registering train from the worm on the meter shaft. If desired, either recording mechanism may be detached from the meter shaft when the other train is engaged, and one train may be geared to give a slower rate than the other. In a patent issued to Rudolph M. Hunter, a system is described whereby a meter may be made to record a higher figure for a given current consumed when the station is heavily loaded and may also be made to record faster when the consumer's load passes beyond a predetermined point. These two actions may occur at the same time, or a meter may be supplied with mechanism for one only. By means of an electromagnet actuated from the central station, either by hand or clockwork, resistance is cut out of the armature circuit of the meter, thus causing it to register faster. To obtain registration for abnormal loads on the consumer's circuit, a solenoid in such circuit throws into action an electromagnet which cuts resistance out of the armature of the meter, thus causing it to run faster. In a patent issued to W. C. Fish, a time element is introduced into the maximum-demand form of meter. The recording hand of the maximum-demand meter is also the hand of a clock. In connection therewith is an ammeter, and when the ammeter needle is sufficiently displaced by current flowing through the ammeter coils to cause this finger to come into contact with the recording hand, a local circuit is closed and a magnet releases the clock movement; the needle and the recording hand then move together slowly along the dial until the latter leaves behind the ammeter needle, which opens the local circuit and causes the clock to stop. Another patent of the same inventor is on a method for eliminating the effect of friction in meters. On the meter shaft is a second armature in series with the meter armature, and working in the field of a permanent magnet. This field is adjusted by movement of the magnet so as to be just sufficient to neutralize, or a little less than neutralize, the starting friction of the meter; that is, keeping the meter just on the point of starting when no current flows in the series coils. This auxiliary armature may form part of the damping disk, and work in the field of the damping magnets. A patent granted to Caryl D. Haskins describes a meter arrangement whereby the amount of energy delivered from a storage battery and also the amount remaining in the battery, will be indicated without requiring calculation on the part of the attendant. Connections are also shown whereby the charging source is thrown out when the meter shows the battery to be fully charged; also, an arrangement of circuits whereby withdrawing a plug cuts out the motor of, say, an automobile, and at the same time changes the meter rate—replacing the plug causing the reverse action. In circuit with the meter armature is a resistance, the short-circuiting of which upon charging will cause the meter to accelerate its rate of registration. This resistance may be selected to accord with any battery efficiency. As the meter registers in one direction in charging and the opposite direction in discharging, a device is also introduced whereby one or another of a set of meter starting coils is cut in or cut out; the current in one starting coil flowing oppositely to that in the other, the motion of the meter is thus permitted to be reversed.

A MEXICAN CABLE.—The Mexican Government has given authority and awarded the contract for the laying of a cable from the port of Altata, State of Sinaloa, to Lopaz, Lower California, a distance of 114 miles. Work must be completed within six months.

MIAMI-HAVANA CABLE LANDED.—A despatch from Miami says the Florida end of the Miami-Havana cable was successfully landed there on Aug. 25. It was a gala day for Miami. The merchants closed their stores and hundreds of persons with a brass band gathered at the terminal station to witness the landing and accord a hearty welcome to this new enterprise.

STEPS TO AVOID TROLLEY ACCIDENTS.—Need for a special session of the Legislature to pass new trolley laws for the protection of the public of Connecticut has been removed by the action of the Railroad Commissioners of that State. They have sent an order to every street and steam railroad in the State, demanding that it promptly furnish the Commissioners with an explicit statement of the number of bridges, their height, the guard-rails used, and the speed maintained in going over them. The Commissioners will enforce the regulations relative to the dangers from trolley accidents mentioned in the report of the Coroner's jury on the Stratford accident and the idea of a special legislative session will probably be abandoned.

FAC-SIMILE TELEGRAPH.—In a patent issued Aug. 22 to Wm. P. Dunlany and Thomas Mills, a fac-simile telegraph based upon the Caselli telegraph is described. The drawing to be transmitted is, as usual, reproduced in insulating ink on a conducting sheet which is placed on the cylinder of the transmitter and reproduced at the receiver by means of impressions from a stylus on a carbon sheet. The stylus at both ends is given a constant vibratory movement by means of local batteries, the receiving stylus thus being in motion both when it is recording and when it is not in contact with the recording cylinder. The mechanism of the transmitter and recorder are similar to each other. The cylinders containing the copy have no motion of translation; such motion being imparted instead to a carriage carrying the stylus, which is advanced by means of a long screw attached to the cylinder. The cylinder and screw are driven by an electric motor at each end, and once during each revolution they are brought into synchronism, should this have been departed from.

A LIGHT-RAY PHONOGRAPH.—An interesting patent was issued Aug. 22 to Josef Chania, of Lemberg, Austro-Hungary, on a phonograph whereby the record is made and reproduced by the action of light-rays. The recorder consists of a box containing a mirror opposite to the mouthpiece; a ray of light is caused to impinge on the mirror and be reflected therefrom and to pass through a prism, which focuses it on the surface of a rapidly moving chemically prepared tape. It is stated that the sound waves thrown on to the reflector opposite the mouthpiece intercept to a more or less extent the light-rays and affects the vibratory action of the reflector, the result being variations in action of the light-rays focused on the sensitized strip. In the reproducer the strip is unrolled, and a ray of light focused upon it is reflected and strikes the rim of a rapidly moving wheel made up of a large number of strips of selenium, the selenium being in the circuit of a telephone receiver. It is claimed that the variations in the record strip result in variations in action of the rays on the revolving selenium strips, the resistance of which is thus varied and causes variations in the current flowing which will affect the telephone electromagnet, whereupon the diaphragm will be actuated and sounds produced.

LETTERS TO THE EDITORS.

Oxidation of Carbon at Ordinary Temperatures.

To the Editors of Electrical World and Engineer:

Sirs:—Mr. Willard E. Case evidently did not read all of my letter published in THE ELECTRICAL WORLD AND ENGINEER, Aug. 12, 1899, or he would not, in his letter published Aug. 26, have accused me of "an attempted confirmation of" his experiments on burnt sugar. I stated that my experiment was "for the purpose of confirming with ordinary electric light carbon of great purity the results obtained by Mr. Case with the residue of burnt sugar." My object was not to go over the work of Mr. Case, but to supplement it—to see whether his alleged reaction could be performed with a kind of carbon which is nearly pure and with carbon which would have a commercial value comparable to the value of coal, or at least comparable to the value of *zinc*, as a material for battery consumption. My experiment was only a preliminary one, suggested by Mr. Case's researches, and I intended (if any chemical reaction had resulted) to try other still cheaper varieties of carbon. Mr. Case's last letter has served to remind me that the carbon I used was made of a mixture of lamp black and molasses. The difference between burnt sugar and burnt molasses is, after all, not great.

It is undoubtedly true, and lamentably so, as Mr. Case points out in his letter, that there are eminent professors of electrical engineering who believe and unblushingly declare that a voltmeter is a sufficient instrument for determining whether electrical energy is derived from the oxidation of carbon in any given mixture of carbon and other chemicals, regardless of the chemical reaction. It may be added that such professors generally know little and care less about the chemical reactions or the thermo-chemical possibilities in question.

PHILADELPHIA, PA. CHARLES J. REED.

Grounding of Secondaries.

To the Editors of Electrical World and Engineer:

Sirs:—It can hardly be possible that Mr. Emmet did not have in mind the Cardew earthing device as well as many others when he proposed to earth one side of alternating current secondaries as protection to life and property. The truth of the matter is that this is one of the most delightfully simple and efficacious ideas which has been proposed in a long time. There are no objections whatever to it, as the same thing has been done for years on all three-wire systems. Of course, the insulation of the secondary system would seem to be of value, from a theoretical standpoint, in preventing lightning discharges between transformer coils, but as a matter of fact, though the insulation resistance of the secondaries may be quite high, the dielectric resistance to rupture is likely to be fairly low, and it is doubtful if the ground insulation of the secondary is of any practical importance. But whether it is or not, it certainly is very unwise to trust to it or even to allow it to take the strain in case of accident, on account of the grave consequences attending the almost certain breakdown.

On circuits of over 300 volts, on the other hand, the wiring must be well insulated, and the apparatus connected should have insulated frames. This insulation has sufficient resistance to rupture to materially aid the transformer in holding up under unusual stress; that is, in case extra insulation at this point is of any value—a matter of considerable doubt. The writer has witnessed scores of burn-outs due to lighting, and has concluded that it is fearfully and wonderfully made, the path which it will take being very hard to predict. For many reasons, however, it would seem best, on circuits of over 300 volts, known as high-potential circuits, not to earth the secondaries, as arc and trolley circuits have proven to be rather too dangerous in the past to make the repetition of their worst feature advisable.

One point of general interest has been made certain by long experience—that during the most severe lightning storms transformers with high dielectric strength do stand up, while those with a somewhat lower value invariably go in large numbers. The place, then, to put insulation is in the transformer, and the Underwriters this year have taken a very wise step in requiring a 10,000-volt hot breakdown test on all transformers, whatever their primary pressure may be, though up to 3500 volts it might well have been at least four times the rated primary pressure, and the running test for ½ hour at double pressure might well have been increased to triple pressure for five minutes. There is no good reason why, with proper lightning protection, we should not enjoy the same immunity from breakdown in transformers as we do in generators. It pays to insulate them with a large safety factor.

To return. Mr. Emmet's proposition is one which does credit to his insight, and the sooner the Underwriters force its adoption, the better. In case they fail, the legislatures should take it up upon competent advice, as a matter necessary to the public safety. Had grounding existed in the past, we should not now be con-

fronted with so considerable a list of victims to ground shocks, containing, as it does, some names which can ill be spared.

IRVING A. TAYLOR.

MONTREAL, CANADA.

Two-Phase vs. Three-Phase Systems.

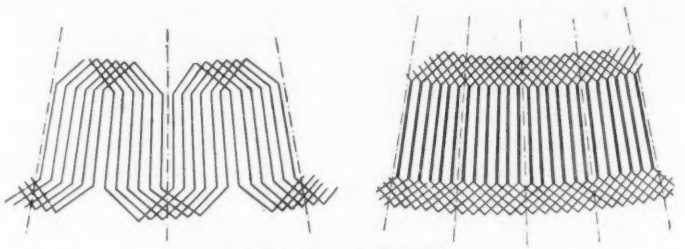
To the Editors of Electrical World and Engineer:

Sirs:—In a letter on two and three-phase systems which appeared in the ELECTRICAL WORLD AND ENGINEER of May 27, I remarked that in the case of two-phase machines of the so-called inductor type, it would be advantageous to wind each armature with one phase only, for which arrangement the following advantages were claimed:

1. Smaller length of armature by doing away with crossed end coils. 2. Easier interchangeability of coils. 3. Possibility of reducing the drop of pressure by employing an amortisseur.

I notice that in a later communication in your columns (July 1) Prof. Blondel expresses the fear that with such an arrangement there will be a strong influence exerted by mutual induction. I will remark at the outset that I agree with Prof. Blondel that it will probably be impossible in two-phase machines to entirely avoid this effect, but in a correct design it can be reduced to a permissible value. Experience shows that exact balancing is impossible in the three-phase system; also, one should be satisfied if the difference of potential with non-inductive loads does not exceed 1 to 1.5 per cent.; with inductive loads, however, this will, of course, be greater.

Now, let us investigate the conditions that exist when the phases are separated. In the usual arrangement the mutual induction takes place at the end connections of the machine, and is especially noticeable when a progressive bar winding is used. As an example, I will cite a machine of 250-kw capacity with a wave winding such as shown in Fig. 1. At full, non-inductive load, the drop of pressure was not less than 9 per cent., and had to be compensated



DIAGRAMS OF WINDINGS.

for by a small transformer with sine and cosine windings. In order to obviate the use of this apparatus, the winding shown in Fig. 2 was used on a new machine, and in this the drop of pressure was only 1.5 per cent.

Sine wave windings are disadvantageous with inductor machines owing to the fact that the inner end-windings make in themselves a complete coil. If, however, this winding is used, it should be wound alternately right and left handed. Separation of the two phases, as suggested, eliminates the influence of the outer end connections. A closer examination shows, too, that the direct effect of the armature turns is reduced to a small value by reason of the screening action of the massive iron cores, a conclusion borne out by observations on ordinary alternating current machines of the inductor type.

Referring to my previous letter in equation (4) page 710 (on page 710 *im* appeared instead of *in*), the e. m. f. of self-induction, divided by the e. m. f., is:

$$\frac{e}{E} = K_1 \rho \frac{I N \sqrt{2} \left(\frac{m}{2}\right)}{pin}$$

in which IN is the total number of ampere-turns per phase; $2p$, the number of poles; m, the number of phases; in the number of ampere-turns in magnets; K_1 a coefficient, which is determined from the no-load and full-load characteristics.

While K, for ordinary single-phase machines varies between 1 and 1.2, this coefficient for the inductor type is from .5 to .6, showing that the two armatures have hardly any influence on each other. In order to arrive at a greater certainty, I had a cast-iron ring made having a mean diameter of 42.4 cm., a cross-section of 407 sq. cm. and 40 coils, traversed by an alternating current. A separate winding with the same number of turns served for the determination of the number of lines of force. In the following table $\mathfrak{B}_1$ is the field density which would result from the number of ampere-turns employed, while $\mathfrak{B}_2$ is the actual measured number of lines.

Current, Amperes.	Max. Amplitude of Amp. Turns per cm.	$\mathfrak{B}_1$	E. M. F. of Self-Induction.	Cycles.	$\mathfrak{B}_2$	$\frac{\mathfrak{B}_1}{\mathfrak{B}_2}$	Watt Loss in Iron.
44.5	18.8	2900	14.8	42.5	485	6.	422
56.5	24.	5100	18.4	43.	595	8.6	6.0
72.	30.5	5700	20.4	42.7	664	8.6	8.6
83.5	35.4	6100	24	42.2	790	7.7	1456
114.0	48.2	7000	26.8	43.3	860	8.1	1734
						Mean 7.8	

These experiments plainly show that the number of lines of force is reduced in the ratio of 7.8 to 1 (mean value) in consequence of the screening effect of the massive iron core. For another iron core only 100 sq. cm. in section, a mean value of 5.5 was obtained. It is quite probable that this relation must remain nearly constant for different excitations, and that the observed differences must be ascribed to the magnetization curve employed, which did not correspond to the particular kind of iron used.

In the inductor type of machine we have a constant field produced by the magnet winding, and a variable field which is due to the armature reaction. In order, therefore, to approach more nearly the actual conditions, I also supplied the iron core with a direct current winding of 3600 ampere-turns. The results are given in the following table:

Direct Current, Amp.-Turns per cm.	Alternating Current, Amp.-Turns per cm.	Total Ampere-Turns.	$\mathfrak{B}_1$ Corresp'nd'ng to Continuous Current, A.-T.	$\mathfrak{B}_3$ Corresponding to Total A.-T.	E. M. F. of Self-Induction.	Cycles.	$\mathfrak{B}_2$	$\frac{\mathfrak{B}_3 - \mathfrak{B}_2}{\mathfrak{B}_2}$	Watt Loss in Iron
27	13.8	40.8	5400	6500	5.	44.	157	5.74	61
27	17.8	44.8	5400	6800	6.	45.3	183	7.65	88
27	25.4	52.4	5400	7250	7.6	44.7	235	7.9	208
27	34.	61.	5400	7700	11.	44.7	340	6.76	400
27	43.3	70.3	5400	8100	15.	44.	470	5.75	690
27	54.4	81.4	5400	8500	21.4	44.	670	4.64	1390
								6.4 mean.	

In this case also the effect of the alternating current was reduced to at least one-sixth. Let us now consider a definite example in which the two phases are kept entirely separate, and in conjunction with which the amortisseur described in my previous letter is used.

The machine is a two-phase machine with 2700 ampere-turns in each armature coil, and 14,000 ampere-turns in the magnet coil. As the armature reaction causes a weakening of the leading phase and a strengthening of the lagging one, we get, without considering the screening action, etc., a total drop of pressure of

$$2 \times 100 \times \frac{2700}{14{,}000} = 38 \text{ per cent.}$$

and considering the degree of saturation, perhaps, 36 per cent.

It should be remarked, however, that the cross section of the air space continually varies according to the position of the poles, and is smallest when the current strength is at a maximum. The mean cross section will, therefore, be only about 60 per cent. of the pole cross section. Furthermore, the experiments show that the lines of force are reduced to about one-seventh through the screening action, and there is still a further reduction of about 50 per cent. due to the use of the amortisseur. The actual difference of potential will therefore be only:

$$\frac{36 \times 0.6 \times 0.5}{7} = 1.6 \text{ per cent.}$$

This difference of potential can be halved again by providing the lagging phase with .8 per cent. less turns. At no load it will then be .8 per cent. less and at full-load, .8 per cent. more, voltage than the leading phase, which is permissible.

The above tables, for which no scientific value is claimed, also contain some information in regard to the approximate losses due to vortex currents and hysteresis.

J. FISCHER HINNEN.

LE RAINCY, FRANCE.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Continuous Current Dynamos with Two Independent Windings.—SENGEL.—The conclusion of his article, the first part of which was abstracted in the Digest Aug. 19. If the branch between one main brush and the third brush is loaded, a similar difference in the sparking at the third brush can be observed, although it is less noticeable than when the dynamo is unloaded. A much greater difference in the sparking takes place in the following two cases: If that branch is loaded which lies between the middle brush and that main brush which precedes it in the direction of rotation, then with increasing load the amount of sparking at the third brush diminishes to zero, but occurs again with a further increase in the load. If, however, the other branch is loaded, the amount of sparking at the third brush increases with an increasing load. If both branches are loaded, the amount of sparking at the third brush is dependent on the difference of the load, in the same way as though only one branch were loaded; the reasons for this phenomenon are discussed. A dynamo of such a form can be used also as a transformer, the primary current flowing between the two main brushes, and the secondary between a main brush and a third brush. The results of tests are given in a table, the ratio of e. m. f.'s varying between 1.9 and 3, the efficiencies between 54.1 and 85.8.—*Elek. Zeit.*, Aug. 3.

Variable Speed Motor.—A short illustrated description of a portable continuous current motor driving a flexible shaft and capable of having a variation in speed of 60 per cent., which is claimed to be accomplished without loss of efficiency. To regulate the speed the pole pieces are made hollow, the cavities being fitted with soft iron masses, which can be withdrawn more or less by means of screws. By moving these iron masses away from the armature, the total magnetic flux will be greatly decreased, thus increasing the speed, but the magnetization of the pole-tips will still remain sufficiently strong to produce sparkless commutation.—*Eng. News*, Aug. 17.

REFERENCES.

Monophase Non-Synchronous Motors.—MAFFIOTTI and PESCETTO.—An abstract with some of the curves of the article noticed in the Digest March 4.—*Science Abstracts*, June.

Compounding Alternators.—LEBLANC.—An abstract of the long series in *L'Eclairage Elec.*, noticed in the Digest Jan. 7.—*Science Abstracts*, June.

LIGHTS AND LIGHTING.

Economical Incandescent Lamp.—MONTEL.—A short article applying the graphic method described in a former article (Digest, Jan. 7) to lamps consuming 2.6 watt per candle. He deduces the curves for each of three prices of the current, namely, 14.4, 9.6 and 4.8 cents per kw hour, the price of the lamp being assumed to be 16 cents. He furthermore gives an interesting comparison between 2.6 watt lamps and 3.3 watt lamps; if the price of the current is 14.4 or 9.6 cents per kw hour, the minimum price of the candle hour for a 2.6 watt lamp is 0.046 or 0.032 cents; for a 3.3 watt lamp with cellulose filament 0.050 or 0.034 cents; for a 3.3 watt lamp with treated bamboo filament 0.051 or 0.035 cents respectively. It will be seen that the amount saved by the use of 2.6 watt lamps instead of 3.3 watt is rather small.—*Zeit. fuer Elek.*, July 9.

Arc Light Formulas.—HARKNESS.—A number of empirical formulas deduced from various tests, connecting the variable elements in an arc lamp.—*Amer. Assoc. Proc.*, 47, p. 140; abstracted briefly in *Science Abstracts*, June.

REFERENCES.

Incandescent Lamps.—RICHARD.—The first part of a well illustrated description taken from patents of the new types of incandescent lamps, such as the Nernst lamp; the Phelps lamp with two or three filaments; the Angenault lamp, in which the leading-in wires are protected by small glass tubes which prevent short-circuiting by sparks and allow 200 volts to be used. Several other new types are also shown.—*L'Eclairage Elec.*, June 3.

POWER.

Mine Haulage.—An article on the development of mine haulage in recent years, the introduction of the electric locomotive being said to be the most important change. The objections to the steam locomotive, such as the difficulty of the disposing of the smoke and gases and the danger from sparks, are referred to. The electric locomotive can be built in very compact form and adapted to mine galleries of almost any size. The usual custom in mines is to supply the current by an overhead bare copper wire. One of the latest types of electric locomotives is illustrated. It has two 50-hp single reduction motors, one geared to each axle; the total weight, ready for service, is 25,800 lbs., the draw-bar pull is 4300 lbs. at 8 miles an hour on a level; there is a rheostatic controller. The compressed air locomotive is said to be at present the principal rival of the electric locomotive for mechanical traction in mines.—*Eng. and Min. Jour.*, Aug. 19.

REFERENCES.

Pinions for Electric Motors.—SCOTT.—A reprint of the article abstracted in the Digest Aug. 26.—*El'ty.*, Aug. 23.

TRACTION.

Electric Canal Boat Towing.—KLINGENBERG.—A long, well illustrated account of the researches referred to in the Digest July 22. The Lamb and the Koettgen systems were operated with continuous current at 500 volt. The high strain on the carrying rope and on the hauling rope are said to be the principal defects of the Lamb system; it operates unsatisfactorily at curves, and its efficiency is limited by the weight of the motor; for these reasons it was replaced by the Koettgen system. The former description of this system in the Digest may be completed as follows: the single rail bears about 85 per cent. of the weight of the locomotive; the towing rope is attached to the locomotive about three feet above the rails, and to the boat at a pole about 16 to 22 feet in height. For smaller canals one towpath at one side of the canal is sufficient, the crossing of trains of boats being performed as follows: if two locomotives meet, they change their ropes, which can be done in one minute, and run back until each meets another locomotive running in the opposite direction. For larger distances it is proposed to use three-phase alternating current at high voltage; it is pointed out that from the central stations generating such current, large districts could be supplied with electrical energy.—*Elek. Zeit.*, Aug. 3.

Substation for Accumulator Road.—A brief illustrated description of the small auxiliary charging station which has been erected at the distant end of the extension to Harvey of the accumulator line in Chicago; it is intended to freshen up the charge when the cars have reached this end station, so as to meet any exceptionally heavy demands on the batteries due to increased traffic or bad weather. There is a 50-hp gasoline engine and the voltage of the dynamo appears to be 160; there are also 95 cells of accumulators; there are 72 cells on each car, having a capacity of 400 ampere hours; 40 minutes is said to be required to fully charge a car battery.—*West. Elec.*, Aug. 19.

American Trolleys for Paris Exposition.—A note stating that at the Paris exposition of 1900 an electric road a mile long is planned upon which will be run model cars made by the different manufacturers of the United States, the overhead trolley system being used. Another novelty of the exposition will be a gigantic umbrella, devised by Sherman, of Chicago, having a steel structure of about 350 feet in height; to each rib of the umbrella a car capable of seating 50 people will be atfached, and these cars will be lifted from the earth to the top of the structure.—*St. R'y Rev.*, Aug. 15.

Jungfrau Railway.—A note stating that the second section of this railway was opened to the public Aug. 3, running from the Eiger glacier to the Rothstock, a rock projecting from the Eiger. It is thought that work will stop as soon as the road has been completed up the Eiger Wand station, unless more capital is subscribed. The report that it is intended to continue the line eventually to the summit of the Eiger instead of to the summit of the Jungfrau, is said to be incorrect.—Lond. *Elec.*, Aug. 11.

REFERENCES.

Milan-Monza Accumulator Railway.—A short description of this railway, for heavy traffic, which was referred to in the Digest April 8.—*Sc. Amer. Sup.*, Aug. 19.

Niagara Gorge Railway.—RICKER.—The beginning of a reprint of the paper noticed in the Digest Aug. 19.—*Elec. Rev.*, Aug. 9.

Oldham, Ashton & Hyde Tramway.—An illustrated description of this English road which was referred to in the Digest Aug. 5.—*St. R'y Rev.*, Aug. 15.

Electric Railway in Corea.—An illustrated description of this trolley line, the recent opening of which excited riots. No technical information is given.—*St. R'y Rev.*, Aug. 15.

Size of Engines for Tramway Stations.—Some discussions as to what should be the governing factor in determining the size of units for a tramway plant.—Lond. *Elec. Eng.*, Aug. 11.

Accumulator Traction at Ghent.—ZACHARIAS.—A reprint of the translation in abstract, noticed in the Digest Aug. 12.—*El'ty.*, Aug. 16; *Elec. Rev.*, Aug. 23.

Storage Batteries for Traction.—GEBHARD.—A paper read before the Electrochemical Society of Vienna. The paper is quite similar to that of Schroeder on the calculation of the power required for electric railways, mentioned in the Digest of March 4.—*Zeit. fuer Elek.*, July 30 and Aug. 6.

Automobile Exposition.—A short note on an automobile exposition to be held in Berlin, Germany, in September. Prizes to the amount of $2500 are to be awarded.—*Elek. Anz.*, July 23.

Automobile Exposition.—KUBICKI.—An illustrated article on the second Automobile Exposition in Paris.—*Elec. Rev.*, Aug. 23.

The first part of another article on this exposition, with many illustrations of phaetons.—*Sc. Amer. Sup.*, Aug. 26.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Installation Estimates.—The conclusion of this series (Digest, Aug. 12, 19). In a table the additional cost of the installation is given, if accumulators are used. The cost of wiring is, of course, very variable; the fact that the larger the installation, the less is the price per point, is shown in a diagram. Another diagram shows how the approximate total cost of wiring, depends on the size of the installation; this curve is nearly a straight line. If the cost of wiring for an ordinary private house is assumed to be unity, the price for other buildings is given as follows: Textile factories, 0.75; printing offices, 0.80; engineering and machine shops, 0.90; breweries, 0.92; paper mills, 0.96; theatre and music halls, 1.00; hotels and restaurants, 1.10; dye works, 1.15. In estimating for large installations it is necessary to know beforehand whether the wires are to be carried overhead or underground; in the latter case, lead covered and armored cable would have to be employed, which is of course very much more expensive. About $1.75 per lamp generally covers the wire and 38 cents per lamp the white wood casing (presumably not including any underground cables), but much depends on whether the lamps are grouped together. The cost of foundation, mason and carpenter's work in connection with the generating plant, generally is about 4 per cent. of the total price of the plant; the cost of erecting the generating plant, including fixing the switchboard and the piping, is about 12 per cent. Some figures are given for the working expenses and the maintenance. The amounts for repairs, depreciation and interest, are taken at 2½, 5 and 5 per cent. respectively on the total capital cost of the installation. In conclusion some notes on arc lamps are given; for outdoor lighting about 1 cp per 10 square feet is allowed, for indoor lighting 2½ cp. The cost of carbons for a 1000-cp lamp is given at half a cent per lamp per hour of lighting. (Many of these figures are, of course, only very rough approximations, but that is all they are intended for. Americans should remember that labor is much cheaper in England; on the other hand, the workmen do not accomplish as much per day.)—Lond. *Elec. Rev.*, Aug. 11.

REFERENCES.

Plymouth Combined Lighting and Traction Plant.—A long, well illustrated description of this plant (see also Digest, Aug. 19).—Lond. *Elec. Rev.*, Aug. 11.

West Ham.—A well illustrated description of this plant which was referred to in the Digest of Aug. 26.—Lond. *Lightning*, Aug. 10; Lond. *Elec. Eng.*, Aug. 11. Reprinted without illustrations in *El'ty.*, Aug. 23.

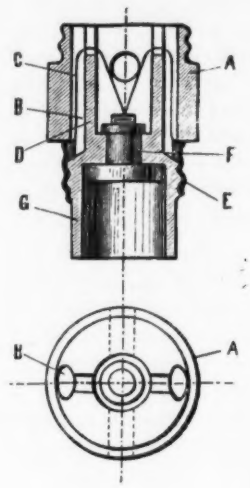
Accounts of Municipal Stations.—STEVENS.—A paper read before the Corporate Treasurers' and Accountants' Institute, of a financial character.—Lond. *Elec.*, Aug. 11.

Voltage Regulation.—An illustrated description of a device intended to regulate automatically the terminal voltage of an installation by varying the resistance in the shunt circuit of the field magnets, by means of two solenoids.—Lond. *Elec.*, and *Elec. Rev.*, Aug. 11; *Lightning*, Aug. 10; *El'ty.*, Aug. 23.

Lightning Arresters.—BOCHET.—The reprint in full of a long paper giving brief illustrated descriptions of a large number of lightning arresters for telegraph, lighting and power circuits.—*Bul. Soc. Int. des Elec.*, April.

WIRES, WIRING AND CONDUITS.

High Voltage Plug Fuses.—SCHIRNIR.—A paper read before the Union of German Electrical Engineers giving an illustrated description of the new high voltage plug fuses, and their applications, which were referred to in the Digest of Aug. 5. The 250 volt plug fuses are made of chemically pure silver, the larger forms operating well, up to 500 volts. If the form is slightly modified, they can be used up to 550 volt and 60 amp. The construction of the fuses can be seen from the adjoining figure. The porcelain body A is used



in the same size for all currents up to 60 amp. The parallel connected fusible wires C lead from the thread E through the channels B over the intermediate partition D through the interior hollow space of the fuse to the contact screw F, and are soldered to the two poles E and F. The interior space of the fuse and the channels are filled with grains of some material which is not hygroscopic and not readily fusible. The separation of the thread from the contact screw is accomplished by the porcelain cylinder G, so that the formation of an arc is prevented.—*Elek. Anz.*, July 30 and Aug. 3; *Elek. Zeit.*, Aug. 10.

REFERENCES.

Boston.—An abstract of the annual report for 1898 by Flood, the Commissioner of Wires.—*Elec. Rev.*, Aug. 16.

ELECTRO-PHYSICS AND MAGNETISM.

The Dark Lightning Flash.—LORD KELVIN.—In a communication he proves that its existence is purely subjective. During a thunderstorm he saw on a suddenly illuminated sky two nearly vertical lines of darkness, each of the ordinary jagged appearance of a bright flash of lightning. He remembered to have seen two real flashes of just the same shapes and relative positions and concluded that the black flashes were due to their residual influence on the retina, which he proved by turning his eyes quickly from the dark sky outside to an illuminated wall inside the house. He then saw again the same double dark "flash." The fatigued part of the eye failed to perceive the sudden brightness of the sky in the one case and of the wall in the other.—Lond. *Elec.*, Aug. 11.

Illumination of Vapors, by Tesla Oscillations.—KAUFFMAUN.—An illustrated paper read before the German Electrochemical Society. If tubes filled with the vapor of an organic liquid together with some of the liquid itself, are exposed to Tesla oscillations, the vapor is in many cases illuminated. If by heating the tubes the pressure of the vapor is increased, the illumination increases for some and decreases for others. From the different kind and degree of the illumination he believes that conclusions can be drawn as to their molecular constitution.—*Zeit. f. Electrochemie*, July 27.

Magnetism and Thermo-Conductivity of Iron.—KORDA.—He shows that the thermo-conductivity of soft iron decreases along the lines of force and remains unaffected in directions normal to them; the theory of the phenomenon is given.—*Comptes Rendus* 128, p. 418; noticed briefly in *Science Abstracts,* July.

Boiling Points in a Magnetic Field.—DU BOIS.—He shows theoretically that a paramagnetic liquid undergoes in the magnetic field an increase in its boiling point and a diamagnetic body a diminution. For water this is 15 millionths of a degree.—*Berl. Phys. Gesell. Verh.,* 17, p. 148; abstracted in *Science Abstracts,* July.

Magnetism at Very Low Temperatures.—ORMOND.—A short note stating that he has found that nickel steels, if non-magnetic to begin with, acquire magnetic properties after five minutes' immersion in liquid air. If most of the nickel is replaced by manganese the same is true. Carbon steel with 1.4 to 1.6 per cent. carbon, after being immersed in liquid air, and then brought back to the ordinary temperature, is found to be very greatly modified; there is an increase in magnetic permeability and in permanent magnetism, and the density is decreased from 7.798 to 7.692; the polish on a surface disappears.—*Science,* Aug. 11.

Effect of Magnetization upon the Elasticity of Rods.—STEVENS and DORSEY.—A short illustrated article on experiments to test the effect of magnetization on the modulus of elasticity by the application of interference methods of measurements. The results are summed up as follows: the modulus of elasticity of wrought iron and steel increases with magnetization; in the case of steel, little difference was observed for loads of 1 kg and ½ kg; in the case of wrought iron the smaller load gave the greater displacement when equal magnetizing forces were used.—*Phys. Rev.,* August.

REFERENCES.

Becquerel Rays.—ELSTER and GEITEL.—An article giving the results of experimental researches on Becquerel rays which were made to test the theories of Curie and Crookes. The results obtained are not favorable to these theories, but they are not conclusive.—*Wied. Ann.,* November, 1898; abstracted in *L'Eclairage Elec.,* June 3.

Pulverization of Cathodes.—HABER and BREDIG.—A reprint of the English abstracts of the article noticed in the Digest Aug. 26.—*El'ty.,* Aug. 16.

Capacity of Poor Conductors.—BORGMANN and PETROWSKI.—A reprint in abstract of the article abstracted in the Digest Aug. 5.—*L'Eclairage Elec.,* June 3.

Conduction in Mixed Electrolytes.—HOPFGARTNER.—An extension of the work of Schrader.—*Zeit. Phys. Chem.* 25, p. 115.

HOFFMEISTER.—A similar investigation of other mixtures.—*Zeit. Phys. Chem.* 27, p. 345; noticed in *Science Abstracts,* July.

Contact E. M. F.—BROWN.—Measurements extended over periods from six months to 7.5 years which do not support a chemical theory of contact e. m. f.—*Roy Soc. Proc.,* 64, p. 369; noticed briefly in *Science Abstracts,* July.

Magnetic Induction.—WHITEHEAD.—A Physical Society paper of a highly theoretical character on the effect of a solid conducting sphere in a variable magnetic field, on the magnetic induction at a point outside. A practical conclusion drawn from the equations is that for the purpose of induction telegraphy, the receiving coil should have its plane vertical and not horizontal, to get the best effect.—*Phil. Mag.,* August.

Radiations in a Magnetic Field.—SHEDD.—The second and concluding part of the lengthy description of his researches with the interferometer, noticed in the Digest, July 22.—*Phys. Rev.,* August.

Magnetism and Molecular Rotation.—PHILLIPS.—A short communication in regard to the different explanations of his phenomenon of the luminous rings, as described in the Digest of July 29, Aug. 12 and 26. He calls attention to an experimental investigation of Lodge, who in 1889 claimed to have shown that there is an electrostatic force associated with a varying magnetic field. Lodge's investigation is discussed editorially and is thought to be "not quite free from suspicion."—Lond. *Elec.,* Aug. 11.

Magnetic Force in Solenoids.—FARR.—"Expressions are arrived at, in terms of zonal harmonics and their first derivations, by which the values of the two components of the magnetic force may be calculated for any point in the interior of a coil."—*Roy. Soc. Proc.,* 64, p. 192; noticed in *Science Abstracts,* July.

Hysteresis and Temperature.—THIESSEN.—A preliminary account of experiments to ascertain the law connecting hysteresis loss with temperature, for the range below the freezing point. The results show that between about 70° C. and 0° C. the hysteresis loss for a given induction decreases for a rise in temperature.—*Amer. Assoc. Proc.,* 47, p. 115; noticed briefly in *Science Abstracts,* June.

Hysteresis.—NIETHAMMER.—Descriptions of investigations under various conditions but chiefly with magnetization by alternating currents.—*Wied. Ann.* 66, p. 29; abstracted at some length with data in *Science Abstracts,* June.

Earth's Magnetism.—WILD.—He points out that discrepancies arise in the values obtained in determining H by unifilar and by bifilar magnetometers, and shows what corrections should be applied to reduce this discrepancy.—*St. Petersburg Accad. Sc. Bull.* 8, p. 239; abstracted in *Science Abstracts,* July.

SCHWALBE.—An article showing that the annual magnetic variation is due to the current circulating in the upper atmosphere.—*Berl. Phys. Gesell. Verh.* 17, p. 138; abstracted in *Science Abstracts,* July.

FOLGHERAITER.—An account of measurements made on ancient vases to determine the magnetic inclination at the place and time at which these ancient vases were made in Italy and Greece. He also suggests that rebaking the vases might enable the magnitude of the earth's field at that time to be determined also.—*Roma. R. Acad. Lincei Atti* 8, p. 121; abstracted in *Science Abstracts,* July.

ELECTRO-CHEMISTRY AND BATTERIES.

Carbon in Electrolytic Iron.—HOULLEVIGUE.—Electrolytic iron is far from being the purest that can be obtained, as is generally considered. Besides the large quantities of hydrogen, amounting to from 100 to 150 times its volume, there are numerous small impurities, the important one being carbon. Experiments are described showing that carbon *dissolved* in steel is not carried along with the current, but remains as a muddy deposit; the *combined* carbon, however, is carried along with the iron in the direction of the current, as it seems to consist of a complex ion which is carried bodily to the cathode.—*Jour. de Physique* 7, p. 708; noticed briefly in *Science Abstracts,* June.

Progress of Aluminum.—An article on the advance made in the extraction and treatment during the last two years. In the Heroult process, one pound is obtained for 12 electrical hp hours with three to five volts at a temperature of 750 to 850°; the theoretical quantity for 1-hp for 24 hours is 5.487 lbs.; taking the mean of Wallace's voltages the energy efficiency is 36.45 per cent. and the current efficiency 60.07 per cent.; two or three years ago these figures were 22.7 and 40.6 per cent respectively.—Lond. *Engineer* 87, p. 155; abstracted in *Science Abstracts,* July.

Complex Salts.—ABEGG.—A paper read before the German Electrochemical Society, discussing the properties of the ions, especially of complex salts. A combination is called complex, if one ion consists of a molecular combination of a single ion, and an electrically neutral molecule. The decomposition pressure of the complex salt is higher than that of the single ion; hence the electric affinity of a single ion is increased by the addition of a neutral molecule. The paper and the extended discussion which followed are interesting, but of a highly theoretical and more of a chemical than electrical character.—*Zeit. f. Electrochemie,* July 27.

Bleaching Sugar Liquor.—LALLEMANT.—An article giving the results of practical tests of a method devised by Urbain to bleach sugar by the simultaneous action of sulphurous anhydride and electrolysis, electrodes of zinc and later of lead, being used. The results obtained are favorable to a practical application of the method.—*Bull. Assoc. des Chimistes de Sucrerie,* March; abstracted in *L'Eclairage Elec.,* June 3.

Electrolysis of Organic Bodies.—SCHALL.—A short paper read before the German Electrochemical Society. Referring to Prof. Nernst's paper (Digest, Aug. 12) he discusses fused organic salts, and states that with increasing temperature they vary greatly in the increase of conductivity, and in its value. He shows that pure aromatic acids can be decomposed analogously to the fatty acids.—*Zeit. f. Electrochemie,* July 27.

Statistics of the Electrochemical Industry.—In the abstract under this heading, published in the Digest last week, several typographical errors occurred. In referring to the production of power from aluminum it should read "by the formation of alumnina," that is, the oxide and not the metal. In the clause in parenthesis a few lines below, "10 times greater" should have read "100 times greater." At the close of the article the name of the journal should be *Zeit. f. Elektrochemie.*

Hydrogen Generation.—In the abstract under this title published in the Digest last week a typographical error occurred in the formula in the middle of the paragraph in which the square root sign is represented by a V; the formula should read $1/\overline{c} \div C$.

REFERENCES.

Electrolysis of Solution of Sulphate of Copper.—FOERSTER and SEIDEL.—A French translation of an article, published in 1897, in which they give the results of an investigation of the electrolysis of solutions of sulphate of copper, the formation of black copper, the solutions of sulphate of copper at 100° C. and at ordinary temperature with very low and very high current, the solubility of copper in condition of copper at the anode and the electrolytic refining of copper. (A more recent paper of Foerster on the same subject was abstracted in the Digest of June 17.)—*L'Eclairage Elec.*, June 3.

Sodium and Potassium.—A description of an apparatus for their production as lead alloys, by electrolyzing their halogen salts in the fused state.—*Industries and Iron* 26, p. 206; noticed briefly in *Science Abstracts*, July.

Electrolytic Vats.—BECKER.—A serial giving brief abstracts of the more important patents.—*L'Ind. Electrochimique*, 2, p. 57, etc., abstracted briefly in *Science Abstracts*, June.

Electrolytic Estimations of Cadmium.—RIMBACH.—He is convinced of the convenience and accuracy of the electrolytic method, a description of which he gives.—*Zeit. Analyt. Chemie*, 5, p. 284; noticed briefly in *Science Abstracts*, June.

Purification of Sugar by Ozone.—VERLEY.—A reprint in part of the paper abstracted in the Digest, Aug. 19.—*L'Eclairage Elec.*, June 3.

Preparation of Saturated Solutions.—VAN'T HOFF.—A short paper read before the German Electrochemical Society in which he recommends measuring the conductivity of solutions, or the e. m. f. of a cell with proper electrodes, in order to determine the degree of saturation of solutions; he claims that such electrical tests are better than the chemical tests, for the measurements of specific gravity, especially when it takes a long time until the saturation is completed, and when repeated tests during that pariod are to be made.—*Zeit. f. Elektrochemie*, July 20.

Amphotere Electrolytes.—BREDIG.—A paper read before the German Electrochemical Society, dealing with the theory of "amphotere electrolytes," i. e., of such electrolytes which if diluted in water can have at the same time a basic and an acid nature, by producing as well positive hydrogen ions as negative hydroxyle ions. He develops the law of dissociation for such electrolytes and gives a preliminary account of researches showing that of the three amphotere electrolytes which he investigated the stronger acid was also the stronger base.—*Zeit. f. Elektrochemie*, July 13.

Electrodes of the Third Kind.—LUTHER.—He discusses such electrodes, which are reversible, with respect to a metal which decomposes water; as, for instance, a lead plate immersed in a solution of a calcium salt saturated with both calcium sulphate and lead sulphate; the electrodes behave as though there was a peculiar metallic modification of calcium with the special solution pressure.—*Zeit. Phys. Chem.*, 27, p. 364; noticed briefly in *Science Abstracts*, June.

Chemical Actions of Brush Discharge.—BERTHELOT.—A long series of further experiments concerning the action of the electric effluvia, especially in the fixation of nitrogen by organic compounds.—*Annal. Chim. Phys.*, 16, p. 5; abstracted in *Science Abstracts*, July.

Calculation of Ionization from Conductivity.—JAHN.—A mathematical article showing the validity of such calculations.—*Zeit. Phys. Chem.*, 27, p. 354; abstracted briefly in *Science Abstracts*, July.

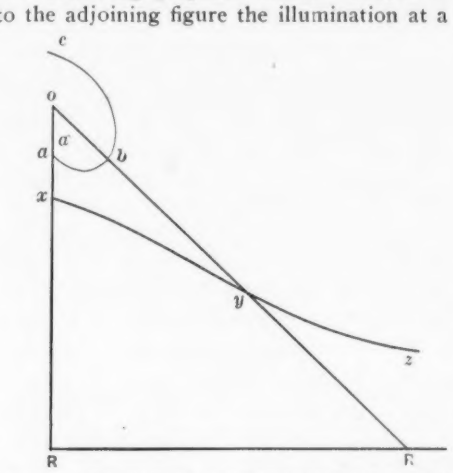
Speed of Electric Reactions.—COHEN.—A paper of a theoretical nature, read before the Electrochemical Society, on the speed of the reactions taking place in certain galvanic cells.—*Zeit. f. Electrochemie*, July 27.

Electrochemistry in 1898.—BORNS.—In the continuation of his article (Digest, Aug. 26) he deals briefly with the electric production of zinc, iron, nickel, chromium, with the electroplating of wood, electrolytic cleaning of metals, actinic effects, electric furnaces and their products, calcium carbide and acetylene.—*Eng. and Min. Jour.*, Aug. 19.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Thermophone.—A well illustrated description of an instrument for indicating temperature at a distance, devised by Whipple and Warren. The principle is that of the Wheatstone bridge. One of the two arms in the part subjected to the temperature to be measured, contains a resistance of copper and the other, one of German silver, or in general, resistances of two materials of different temperature coefficients. If these two resistances are brought to the temperature which is to be measured, and this temperature changes, the resistances and their proportion also change, as it is dependent on that temperature. The other two arms of the bridge, which are conveniently arranged in a box, are formed of a bare German silver slide wire, arranged in the form of a circle, over which a radial contact arm is moved; the proportion of the two parts of the circle can then be made equal to the proportion of the two resistances in the other two bridge arms. A telephone receiver, and an interrupter are used in place of the galvanometer, and so placed that the temperature at the distant point can thus be read directly on a dial around the circular slide wire. The battery used is a dry cell, and together with the interrupter, the German silver wire and the dial, are contained in a portable box. The other two bridge arms are encased in a small brass tube which is either straight, or bent into a coil or a ring. With a thermophone constructed for ordinary use, having a range from 15° to 115° F., temperatures can be read to 0.1°.—*Eng. News*, Aug. 17.

Graphical Method of Determining Illumination.—HOEST.—When it is required to find the illumination at every point of a horizontal plane due to a luminous source whose intensity in every direction is known, the following graphical method affords a rapid means. Referring to the adjoining figure the illumination at a point R of a



GRAPHICAL METHOD OF DETERMINING ILLUMINATION.

horizontal surface due to a source whose height is $O\ P = h$ and whose intensity in the direction of the point is I, is given by the formula $I\ cos^3\ a \div h^2$, in which a is the angle made with the vertical by the line joining R to the source. (In the abstract from which this is taken, this formula is twice written $I\ h^2 \div cos^3\ a$, which is evidently incorrect.) To find the curve $x\ y\ z$, whose radius vector $Oy = I$ gives the luminous intensity of an ideal source which produces a uniform illumination over a horizontal plane, we have to put $Oy\ cos^3\ a \div h^2 =$ a constant, which gives $Oy = Ox \div cos^3\ a$ so that this curve can be easily drawn. This standard curve $x\ y\ z$ is then a very useful one for the rapid determination of the illumination on the horizontal plane, due to any other source, such as the one whose luminous characteristic is represented by $a\ b\ c$ in the figure, as for instance for an arc light. The illumination at a point R is then $Ob\ cos^3\ a \div h^2 = k\ Ob \div Oy$ in which $k = Ox \div h^2$ is a constant. Hence the horizontal illumination at any point is at once determined by multiplying the constant value k by the ratio $Ob \div Oy$ corresponding to the point considered.—*Bull. Assn. Ing. El. Liege*, 9, p. 464, 1898; abstracted in *Science Abstracts*, June.

Measuring High Voltages.—JONA.—A slight generalization of the Peukert method in which the voltage is measured on a fractional part of a circuit, using a series of n equal condensers, so that the whole voltage is n times the voltage between the terminals of one condenser (see Digest, Oct. 22, 1898). Jona shows that *unequal* condensers in series can also be used. The voltage is then to be calculated from the law that the potential difference is divided among the condensers in the inverse ratio of their respective capacities. He says that the use of unequal condensers offers the advantage that the condensers of small capacity consume the greater part of the potential difference.—*L'Eclairage Elec.*, June 3.

REFERENCES.

Collimator Magnets and the Determination of the Earth's Horizontal Component.—CHREE.—A short abstract of a Royal Society paper on the results of an examination, at the Kew Observatory, of over 100 collimator magnets used in observing the horizontal force and declination. The temperature and induction coefficients, and the moments of inertia of these magnets were determined, and the tables, based on these determinations, serve to reduce magnetic observations at a large number of the leading Engli h magnetic observatories.—Lond. *Elec.*, Aug. 4.

Measurement of Inductive Power.—BARBILLION.—A long, illustrated article describing the different methods of measuring the inductive power, depending on the use of Hertzian oscillations.—*L'Eclairage Elec.*, June 3.

Damping of Galvanometer Needles.—LEMKE.—A simplification of Schering's formula. He regards the motion of the needle as the sum of three simple damped oscillations.—*Wied. Ann.*, 67, p. 828; noticed briefly in *Science Abstracts*, June.

Harmonic Analyzer.—DES COUDRES.—A proposition for constructing such an analyzer.—*Berl. Phys. Gesell. Verh.*, 17, p. 129; noticed briefly in *Science Abstracts*, July.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telegraphy.—A notice from the daily papers mentioning that experiments had been made by Cantor of a new system of wireless telegraphy devised by Prof. Braun. The experiments were made in Cuxhaven, Germany. The system is not described, but it is claimed to be a very reliable one and enables the ordinary writing apparatus to be used.—*Elek. Anz.*, July 23.

REFERENCES.

Multiplex Telephony.—SCHWENSKY.—A reprint of the long translation in abstract, with illustrations, noticed in the Digest, Aug. 5; the original was noticed Jan. 14.—*Elec. Rev.*, Aug. 9.

Cairo-Cape Telegraph.—A brief illustrated description of the building of the African Transcontinental Telegraph Company's lines.—Lond. *El'ty*, reprinted in the *Elec. Rev.*, Aug. 16.

The Combination of Double and Single Wire Telephone Circuits.—VALLANCE.—An illustrated reprint of the article noticed in the Digest, May 27.—*L'Eclairage Elec.*, June 3.

MISCELLANEOUS.

Loss of Life by Lightning.—HENRY.—A brief abstract, with a map and a table of an article published by the U. S. Department of Agriculture. The statistics seem to have been gathered from newspaper clippings. The average number of deaths per year in the United States, for the last eight years, is 312, which is about 5 per million of inhabitants; this figure is somewhat larger than the general one in Europe, excepting the Austrian Alps and Prussia; in Styria and Carinthia it is about 10 per million; in Prussia from the latest statistics it is about 6. The chart shows the average number of thunderstorm days in various sections of the United States.—*Elec. Rev.*, Aug. 16.

Globular Discharge.—LEDUC.—A description of a form of discharge which represents a closer analogy to globular lightning than has yet been discovered. Two fine metallic points 5 to 10 cm. apart, are connected with an influence machine and are "set upon the face of a sensitive plate which rests upon a plate of metal." From the negative point a ball of light travels to the positive point. On developing, the plate shows the path of the globe sharply marked.—*Comptes Rendus*, July 3; abstracted in Lond. *Elec.*, Aug. 4.

Earth Plates.—Three short communications showing why the earthing plate of a lightning conductor is always surrounded with coke saturated with water before being covered up. One of the actions is that a coating of sulphide is thereby formed on the copper plate which prevents it from further corrosive action due to the damp soil; the absorption of moisture by the coke is also said to keep the plate damper than it would otherwise be.—Lond. *Elec. Eng.*, Aug. 4.

Ground Connection of Lightning Conductors.—CONSTABLE.—In a short communication he recommends giving the rod a surface of contact with the earth, at least 1000 times greater than the area of the outside surface of the rod for an inch of its length. Water mains make a good ground connection.—*Eng. News*, Aug. 17.

Oscillation Gauge for Ships.—A short note stating that an instrument was made for measuring the oscillations of ships, consisting of a gyroscope, driven by a small electric motor mounted in gimbals, the armature running on a vertical axis. The gyrostatic action of the armature keeps it in a vertical position, and by means of pointers the amplitudes of the oscillations are indicated.—Lond. *Elec.*, Aug. 4.

Protection Against Electric Storms.—LOWE.—A communication in which he suggests mounting wires on iron poles, and bonding the rails of steam railways, grounding them at intervals at the depth necessary to reach water; this he believes will carry off charges and thus prevent electrical storms.—*Sc. Am.*, Aug. 5.

Holland Submarine Boat.—A short description of this boat intended for war purposes. It is provided with a 150-hp gasoline engine, which is made use of for propelling the boat when running on the surface, as well as for operating a 50-hp. dynamo by means of which the storage batteries, weighing in all about 40,000 lbs., are charged. From preliminary tests made it is claimed that when the boat is speeding under water propelled by electricity from the storage batteries, it makes better time than when running on the surface under gasoline engine power.—The conclusive test will be made shortly.—*El'ty*, Aug. 23.

REFERENCES.

Mariners' Compass.—GELCICH.—A description of the Florian compass in which the compensation is made as simple as possible.—*Zeit. f. Instrumentenkunde* 18, p. 339; noticed briefly in *Science Abstracts*, June.

New Books.

LECONS SUR L'ELECTRICITE. PROFESSEES A L'INSTITUT ELECTROTECHNIQUE MONTEFIORE. By Eric Gerard. Volume I. Sixth edition. Paris: Gauthier-Villars et Fils. 819 pages, 338 illustrations. Price, 12 francs.

The first volume of the sixth edition of Prof. Gerard's admirable elementary treatise on electrical science contains many additions of new matter, the number of pages being thereby increased a hundred or more. Among the notable new features is the application of the modern term of ions to the study of electrolysis. Considerable extensions have been given to the sections treating of the phenomna of inductance in circuits and in the mass of bodies traversed by alternating currents, and in the section on electric waves the subject of radio-conductors has been added. In the chapters on electrometry, extensions have been given to the methods of measurement of potential difference, hysteresis and permeability. The chapter on storage batteries has also received additions, both with respect to the theoretical and descriptive portions. It is not too much to say that this treatise still remains the most satisfactory written in any language in its character of a complete elementary text book for electrical students, and a source of theoretical reference for engineers.

Motor Starting Rheostats.

BY OTTO MATTICK.

Whenever the machinery operated by an electric motor becomes stalled or greatly overloaded, the operator in cutting out resistance when again starting up may move the rheostat lever too fast, causing a damaging current to be sent through the motor unless an independent circuit breaker is present to open the circuit as soon as the current exceeds a predetermined maximum. The old type single lever rheostat does not have this important feature, and cannot have it.

When there is an independent circuit breaker in circuit, the operator soon learns how fast to move the lever so as to properly start the motor without causing the circuit breaker to operate because of excessive current. In the case of the old-fashioned single-arm rheostat, the motor is subjected to damaging strains every time the rheostat arm is moved too fast, and in this way the operator can, and usually does, send an excessive current through the motor every time it is started. Even if the motor does not burn out immediately when so treated, its life is greatly shortened. A first-class motor starter will automatically educate the operator how to properly start the motor, as it will not allow him to start it in any other way. The circuit breaker should be beyond the control of the operator, so that if the motor is absolutely stalled, he will not be tempted to hold the breaker in circuit.

A frequent cause of damage to motors is due to improperly connecting the motor's armature and field circuits to the supply line, and then trying to start the motor. The old-fashioned single arm rheostat offers no protection against this risk. But if the rheostat has, combined with it, an automatic overload circuit breaker

which opens the circuit independently of the rheostat lever, no harm can come to the motor, even though the operator should try to start it up while it is improperly connected with the supply line. Whenever the supply of current fails, as for example, when the power plant in a factory is shut down at noon and at 6 p. m., the rheostat lever should be automatically moved back to its initial position, so that when the current supply is again established no current can pass through the rheostat and motor until the operator manipulates the starting rheostat. Of course, the rheostat lever should be similarly moved automatically to its starting position whenever the E. M. F. fails from any other cause, such as the opening of a switch in the motor circuit, the opening of the circuit breakers at the main switchboard or the blowing of a fuse in the circuit leading to the motor.

When the E. M. F. gradually dies down to zero, as when the engines are shut down, the residual magnetism of the underload holding magnet frequently amounts to so much that this magnetism, together with the "friction of rest" between the rheostat lever and the contacts upon which it rests, will prevent the spring from starting the lever, which, consequently, remains in its final or short circuit position. If the rheostat has an overload circuit breaker acting independently of the operating arm of the rheostat, this circuit breaker will automatically and instantaneously open the circuit and no harm will be done. With the old type of single arm rheostat, if the operating arm of the rheostat should stick because of the friction of the contacts, residual magnetism, etc., the overload device is useless, since it merely actuates the underload device which has already failed to perform its functions.

In order to make the underload release positive in its action, it is necessary to overcome the "friction of rest" above referred to, and to do so a sharp hammer-like blow should be given to the rheostat arm to start it against this friction. Otherwise the action of the underload release will be unreliable, especially in the case of rheostats having large currents to carry. The underload release of all contact arms having more than 80 amperes to carry should be provided with this hammer blow attachment or some equivalent device.

The rheostat operating arm should cause the closing of the circuit breaker whenever the resistance has been all inserted and the rheostat circuit opened, and it should be impossible for the operator to close the circuit breaker except under these conditions. This absolutely prevents the possibility of closing the circuit breaker except when the rheostat is in its starting position and with the circuit open.

The circuit breaker should be one in which a strong spring acts against a latch, and the overload device should not only release the latch, but should also simultaneously deliver a hammer blow to start the switchblade from rest.

The circuit breaker should have an auxiliary break in multiple with the switch so that the final opening of the circuit will occur upon renewable contacts designed for the purpose. In this way all arcing at the switch contacts is avoided.

In the old type single arm rheostat having underload and overload attachments, whenever the overload device operated, the rheostat operating arm was caused to move backward over the resistance contacts while an excessive current was flowing through the resistance. This comparatively slow movement of the operating arm backward inserting resistance while a heavy overload current was flowing caused destructive arcing upon the lever and rheostat contact plates, roughening the contact so as to cause excessive heating of the contacts and causing greatly increased friction, which prevented the movement of the lever backward, the next time the underload release was called upon to act.

A motor starting rheostat whose underload release fails to operate is as bad a fire risk as one whose overload device fails to work; hence it is very important to have them entirely independent so that if the underload release should fail to insert the resistance, the overload device will not be affected thereby, but will act entirely independently to open the circuit in the presence of excessive current.

A starting box is not intended to be used for operating a motor at reduced speeds, and if by improper usage or because of failure of its own protective devices, it should be subjected to a current for so large a time as to burn the rheostat out, the design of the rheostat should be such that the melting of the resistance shall not give rise to danger from fire. All rheostats in which coils of wire are placed inside of an open-work, box-like case, so that when the wire is melted it can uncoil and continue arcing, are an extremely bad fire risk, and their only excuse for existence is that they are cheap.

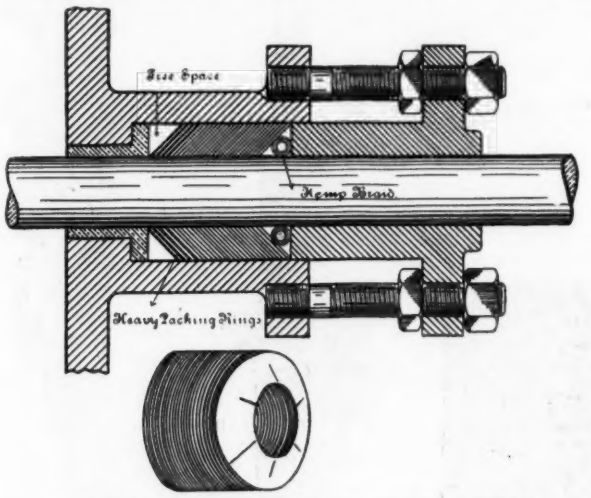
The resistance material of rheostats should have an extremely low temperature coefficient; that is, the "resistance hot" should not differ materially from the "resistance cold." A motor starter made of copper wire will in practice have its resistance doubled; if made of iron wire the resistance in practice will increase 300 or 400 per cent. If made of carbon or a mixture of carbon with clay or similar binder, its resistance will be halved. There are scorces of high-grade resistance alloys on the market, and users of motors should insist upon rheostats made from such alloys, if they wish to obtain a first-class motor starter.

As all protective devices are liable to occasional failure, and can be made inoperative if a person maliciously attempts to do so, the design of every starting box should be such that even if the resistance be burned out no fire could possibly result. It is, therefore, desirable to have the resistance enclosed in an infusible material which will not combine chemically with the resistance material under the influence of an electric arc, and that there shall be no communication between the arc and the outside air. Moreover, there should be such a large mass of infusible material surrounding the resistance that even though it be fused the sensible temperature at the exterior of the rheostat will not be raised enough to make it a possible fire risk. Coils of wire depending upon their own tensile strength to hold them in position and merely mounted in an open box are a serious fire risk.

A New Metallic Packing for Stuffing Boxes.

Within recent years much inferior material has been placed upon the market intended for use in stuffing boxes of engines, pumps and other machinery, and engineers have become somewhat sceptical as to the merits claimed for materials of this character and are apt to be cautious in making their choice. Recently, however, the German government has adopted for use on all its warships and railroads, a new kind of packing, which after thorough trials has given entire satisfaction, it is reported, and has merited the many important claims made for it by the manufacturers. It consists of copper and nickel rings, manufactured from the so-called "Galvanic Metal Paper."

It is claimed that this packing, shown in the illustration, needs no



A NEW METALLIC PACKING FOR STUFFING BOXES.

care or attention after the stuffing box is well packed and seldom needs renewing. It does not scratch the piston rod, nor does the rod have to be cleaned and smoothed. It is self-lubricating and permits the use of superheated steam with its attendant economy, as the packing is not affected by as high a temperature as 350° C. The Galvanic Metal Paper Company, 72 Broadway, New York, who are the manufacturers of the packing in this country, state that many prominent concerns have tested and adopted this packing in the United States.

Trolley Car Brakes.

The New York State Railway Commission has been carrying on this week in New York a series of interesting tests on brakes for street cars, with a view to the adoption of some standard forms.

The Toerring Enclosed Long-Burning Arc Lamp.

The rapid introduction and improvement of the enclosed arc lamp has been one of the features of recent advance in the field of electric lighting. The march of progress still goes on, and we are now enabled to give details of the latest comer in this important branch of work, the lamp of Mr. C. J. Toerring, of Philadelphia. This lamp, with the arc adjusted to 85 volts, has burned, it is said, over 300 hours with 12 inches of carbon, and under usual conditions will burn from 200 to 250 hours.

The mechanical and electrical construction of the lamp embody the best material and workmanship. The factor of safety is high, the insulation of all vulnerable parts, such as magnet spools, resistance wire, etc., being especially heavy, and able to carry excessive current.

The trimming and adjustment of the lamp form a radical departure from the methods heretofore in vogue. The problem of trimming the lamp hot has been successfully met by designing the lamp so that the cylinder can be removed without first being obliged to extract the stub of the upper carbon from it. When the cylinder is removed, which can be done without removing either carbon, both carbons are perfectly accessible. It is also unnecessary to measure and cut the negative carbon to gauge, the only requirement being to break off the protruding end below the holder, which may be done with a pair of pliers.

The adjustment of the lamp is not, as often hitherto, a difficult and uncertain operation. By merely lowering the globe the resistance becomes easily accessible. Adjustment is made by moving a brass band up or down on the porcelain cylinder, insuring a large and perfect contact. The construction of the rheostat or resistance is also an improvement. It consists of a high resistance wire, laid in the grooves formed on the surface of a large porcelain cylinder. This construction adds to the heat radiating surface, and permanently holds and separates each turn of the wire.

One of the principal difficulties with enclosed arc lamps has been the necessity of passing the upper carbon through a contracted and closely fitting opening when inserting the carbon into the cylinder.

FIGS. 1, 2 AND 3.—TOERRING LAMP.

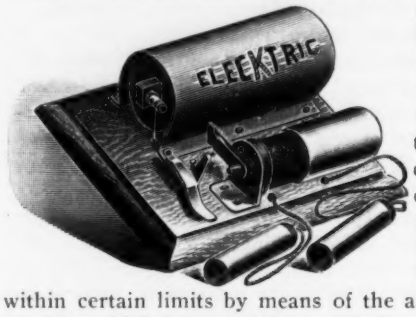
In the Toerring lamp no trouble is possible from this source, as the upper carbon is at all times entirely in the cylinder, there being therefore no necessity to pass it through a narrow opening.

The lamp is short, measuring 26 inches over all; it weighs about 18 pounds with globe. The design of the trimming is neat and ornamental, and is made in any desired finish. The lamp is made for 110 and 220 volt direct current circuits. A 500-volt and a series lamp are in preparation. The outdoor type is thoroughly weatherproof and requires no hood.

Mr. C. J. Toerring, the designer of the lamp, is by no means a novice in this line of work, having been engaged in some of the pioneer work immediately after graduating from Cornell University in 1893. Since that time he has worked with various lamp manufacturers, and recently engaged in business for himself.

A Dollar Medical Battery.

That a medical battery can be sold for such a small sum as one dollar would have seemed impossible a few years ago. That illustrated herewith, which is retailed at the price named, is, notwithstanding the very low price, an efficient apparatus. It consists of a dry cell mounted on a baseboard carrying also the induction coil. The frequency can be regulated within certain limits by means of the adjustable contact maker on the left, which is carried by a switch making and closing the battery circuit. A metal tube sliding over the coil enables the intensity of the shock to be regulated. With the tube covering the entire coil, barely a tingling sensation is experienced, while with the tube entirely removed, a powerful shock is given; in intermediate positions, the tube grades the intensity of the shock. The battery is made by the Knapp Electric & Novelty Company, 127 White street, New York.



Use of Electricity in Making Glass.

If recent reports be true, the application of large currents of electricity to glassmaking may change some of the conditions of that art, and open up another field of electrical work. The subjoined despatch from Anderson, Ind., of Aug. 27, refers to Mr. Macbeth, well known as a lamp glassmaker and as the manufacturer of holophane globes for electric lighting purposes: Charles Macbeth, the big lamp chimney manufacturer, to-day patented a new and decidedly novel process, which will probably revolutionize glassmaking. Heretofore the greatest trouble in glass manufacture lay in the melting of the sand. It has taken a great deal of time, and requires good fuel, natural gas being the best. While passing through his plant recently, Macbeth saw a globe on an arc light break, and a piece of the glass fell over on the carbon. In a second it was reduced to liquid and dripped to the ground. That gave him his cue, and he directed the construction of a big vat, with sides and bottom composed of carbons, over which he could turn a current. An arrangement was made to run the sand through this vat. It worked perfectly, and the very best molten glass is now being turned out in almost as many seconds as it required hours for the old fuels to melt it. The vat was patented to-day, and is now being used. It is so arranged that it can be adapted for every kind of glassmaking from plate to bottles. This invention, in connection with the automatic blowing machinery which is being turned out, is likely to have a great effect on glassmaking. The cost of melting by this process is not as great as with the use of coal or oil, although it may be more expensive than natural gas. At present it takes twelve hours to melt a pot of glass and sand.

Heavy Motor-Truck Record.

The motor-truck record for Great Britain has just been made by a four-wheeled steam truck manufactured by Clarkson & Capel, which accomplished the journey from Liverpool to London, 220 miles, carry 3½ tons, in 43¾ hours. The time would have been much better but for an accident to the burner, and in some places delay caused by the difficulty in getting water, owing to the extensive drought. The cost has been worked out to have been two cents per ton per mile. Several very steep hills were easily negotiated. The test has excited the greatest interest in England, and it is stated that some of the largest engineering concerns in the country are taking up the work of making such automobiles.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Just why the past week was dull in the street it would be hard to say, but perhaps one cannot go far astray in attributing it to the effect of the Brooklyn Rapid Transit report, which has already been noted, and is again referred to in this issue. But it may be doubted whether that one weak spot can continue to influence the whole market, especially as the report itself marks the emergence of the system from bad conditions into the sunshine of those which are decidely more favorable. The man who takes odds against the natural growth of such a business in such a city as Brooklyn is playing a rather desperate game. On the whole, the market stands all such strains wonderfully well, and gets harder every time it is punched, the chief reason being that stocks are not at their highest level and that the prosperity of the country instead of being fully discounted has still to find its proper reflection in average stock prices. During the week, 4192 shares of Western Union were dealt in, closing at 89, a gain of ⅜. American Tel. & Cable was quoted at 100. General Electric was inactive, and on 1700 shares closed at 124. Brooklyn Rapid Transit was a whirlpool and on dealings in nearly 400,000 shares declined 4⅞ to 104⅛, although that was by no means the lowest point reached. Metropolitan Street Railway sympathetically was weak and on sales 10,635 shares closed at 206½. In Boston, American Bell Telephone closed at 348; Erie Telephone at 101½; Mexican at 5½; New England at 143 bid; Michigan at 100 asked; Boston Elevated 109. In Philadelphia, Electric Storage Battery closed at 150-151 common and 154-155 preferred. All other local securities were flat and dull. In Chicago, Union Traction closed at 35; West Chicago at 119; National Carbon common at 22, preferred at 85½. Among "outside" securities in New York, Electric Boat common closed at 24-26 and preferred at 46-48; Electric Vehicle common 109-110; preferred 118-125; Electric Axle 7¾-8; New York Elec. Vehicle Transportation, 24½-25; New England, 9¾-10; Illinois 5¼-5⅜; General Carriage, 33¼-37; New York Gas and Electric 4s, 90-92; 5s, 107-108; Otis Elevator, common 34-35; preferred, 96-100.

CALIFORNIA NEWS.—Electrical finance in California is cheerful, and dividend reports are frequent. The Central Light & Power Company has declared its fourth dividend of 5 cents per share, payable on the 21st. The Pacific Auxiliary Fire Alarm Company paid a quarterly dividend of 5 cents per share on the 14th. Dividends were paid last month by the following San Francisco corporations: Oakland Gas Company, 25 cents per share, $7500; Pacific Telephone Company, 40 cents per share, $13,200; Sunset Telephone Company, 25 cents per share, $7500. Power work is developing. Meetings of the boards of directors of the mining companies of the Comstock lode are being called for the purpose of ratifying and signing the contract for cheap electrical power for the mines, with the Truckee River General Electric Company. Once the contract is signed the work of constructing the power plant on the Truckee River, near Floriston, will begin, and it is expected that the power will be delivered to the mines within six months. The cheap power project is the second great step towards modernizing the methods of operating the Comstock mines and reducing the cost of expenses, the first of these steps having been the drainage of the lower levels preparatory to the resumption of deep mining.

CHICAGO UNION TRACTION will, it is said, soon be brought to the attention of both investing and speculative interests. The capitalization consists of $12,000,000 5 per cent. preferred stock and $20,000,000 of common. The earnings of the company are now at the rate of about 3 per cent. on the common stock. It was figured some time ago by a competent authority that after making proper allowance for the ordinary increase in travel during the summer season, the earnings applicable to the ordinary shares would, for the year, be equal to about 2 1-5 per cent. on the common shares. Such an amount earned on the common would mean total net earnings of about $1,040,000. This is equal to something over 8 per cent. on the preferred stock. A street railroad preferred stock earning 8 per cent. and paying 5 should certainly, in these times of easy money, after some acquaintance with the merits of the property, be selling on a 5 per cent basis, in this instance, at par. It is hardly to be expected that par will be immediately reached, but Union Traction preferred sold recently at 84. Officials of the company are now having a statement prepared to accompany the application to list the stock on the New York Stock Exchange.

BROOKLYN RAPID TRANSIT.—There has been very general disappointment as to the showing of this great system in its last annual report, with a net surplus of $54,541 on $11,035,216 of earnings. But it would seem that better must come. The company feels confident of earning $12,000,000 gross in the current year, and believes that expenses and taxes can be brought within 55 per cent. of the gross earnings or to say $6,600,000. In this event there would be $5,400,000 left for charges and dividends. Fixed charges for the current year will be $3,406,000, leaving, if expenses are 55 per cent., $1,994,000 for dividends. This with $45,000,000 of capital would be practically 4½ per cent. The ratio of operating expense in the year just closed was 62.9 per cent. Assuming that the company can do no better than 62 per cent. in the current year the net earnings would be $4,560,000 and the amount available for dividends $1,154,000, or about 2.6 per cent. on the stock. It seems safe to assume, therefore, that for the coming year the earnings on Brooklyn Rapid Transit will be between 2½ and 4½ per cent.

ELECTRIC VEHICLE COMPANY.—The annual meeting of the stockholders of the Electric Vehicle Company will be held the latter part of September when a statement will probably be made which will not only indicate the business done by the Electric Vehicle Company, but also that of the various sub-companies. These will include the Electric Vehicle Transportation Company, of New York, the N. E. Electric Vehicle Transportation Company, and the Illinois Electric Vehicle Transportation Company. The full year's dividend of 8 per cent. has been paid on the preferred stock of the Electric Vehicle Company and 4 per cent. on the common. It is not yet known whether a further dividend will be paid on the common, although it is said that there is a handsome surplus on hand to do so.

WESTERN UNION DIVIDEND.—Mr. Russell Sage denied a report last week to the effect that because of the vigorous competition on the part of the Postal Telegraph Company and the telephone the earnings of the Western Union have fallen off very considerably, and that, as a consequence, the Western Union would cut its dividend from 5 to 4 per cent. "The earnings of the Western Union," said Mr. Sage, "are very satisfactory. I know nothing about any reported intention of a cut in the dividend, and I don't think there will be any such cut. I do not see why we should not declare our regular dividend. Of course we have had competition, but it has not been such that it has affected our financial standing."

WESTINGHOUSE SCRIP.—The Westinghouse Electric & Manufacturing Company has decided to anticipate the payment of all its outstanding scrip, and has issued a call for the presentation of same for payment on Sept. 1, 1899, at which date interest will cease.

Commercial Intelligence.

THE STATE OF TRADE.—A large quantity of new work is opening up in the electrical field as the fall season begins, giving promise of a very active winter. There would be even more if the prices of steel and iron and copper had not run to such an inordinate height, but it begins to look pretty certain that copper will have to come off its lofty perch and that electrical industries will not much longer be hampered and held back by the cost of their raw materials. It is hard to tell just how much new business is checked in this way, but the percentage is definite. In some respects, the "going slow" has done no harm, but has given the electrical factories a chance to get belated orders cleaned up, and a fair preparation made for future contracts. Manufacturers and contractors report good inquiry in all lines, in keeping with the general trade of the country, which has certainly never been better. The returns of earnings on 73,000 miles of roads, or two-fifths of the whole, show for the first half of August gains of 14.5 per cent. over last year and 8 per cent. over 1892, and on the Granger roads the gains were 19.2 and 17.5 per cent. The tonnage movement, 74.6 per cent. larger than in 1892 for the same weeks, shows greater gain in east-bound than in other traffic. Bank clearings for the week aggregate $1,527,238,000, an increase of slightly less than 1 per cent. over last week, but a gain of 22 per cent. over this week a year ago, of 46 per cent. over 1897, of 104 per cent. over 1896 and 1894, and of 51 per cent. over 1892. Money has been easy, with commercial loans at 4 to 4½ per cent. Failures in three weeks have been in amount $4,075,184, against $4,598,213 last year, $6,338,273 in 1897, and $20,932,285 in 1896. Manufacturing were $1,259,080, against $1,578,633 last year, and trading $1,905,598, against $2,910,114 last year. Failures for the week have been 163 in the United States, against 179 last year, and 16 in Canada, against 26 last year. Iron and steel moved up again. For Bessemer pig $22 and for Grey Forge $19 and for Southern pig $18.60 were paid at Pittsburg; for No. 1 coke $21 at Chicago, and for Anthracite

No. 1 $22.50 at Philadelphia, with 25,000 tons basic sold at $21.50. Copper is quoted around 18-18½ cents.

USE OF CARBORUNDUM.—One of the newer electrical products is carborundum, the abrasive whose discovery is due to the genius of Mr. E. G. Acheson. A large industry has been built up at Niagara in making this substance with the aid of current from the big power plant there. According to F. J. Tone, general superintendent of the Carborundum Company, the outlook in manufacturing lines, and especially in iron and steel, is very promising. "I have been in the East looking over the field," said Mr. Tone, in an interview last week, "and talking with manufacturers who are interested in our product. The demand for carborundum is constantly increasing, and as there are only two factories in the world turning it out—our own and one in Austria—we naturally are kept very busy. Since we have discovered that by the addition of one-half of 1 per cent. of carborundum to 99½ per cent. of steel, steel can be made much more fluid and ductile, the demand for our product has increased greatly among steel men, for it means almost a practical escape from the danger of honeycombed steel. In talking with iron and steel men many of them have told me that they have had far more business than they knew what to do with, and that they had found the same state of affairs in all manufacturing branches. I was particularly impressed at the statements which I heard on all sides of the remarkable increase in present orders for exports. We have had a good foreign demand, and I find the same thing elsewhere. The figures will astonish even the most optimistic." Mr. Acheson has lately turned his energies and attention to the production electrically of graphite, for which also a large market exists.

THE SCOTT-JANNEY COMPANY.—The directors of the Scott-Janney Electric Company met in Philadelphia on August 25 and completed the organization of the concern by the election of the following officers: President, William S. Janney, Philadelphia; Vice-Presidents, Charles W. Drake, New York; Edward A. Abbott, Concord, N. H.; Chief Engineer, Gordon J. Scott, Philadelphia; Secretary, Charles F. Walter, Philadelphia; Treasurer, Jacob Janney, Philadelphia. Finance committee—Charles W. Drake, chairman; T. Quincy Brown, Boston; James B. Dill, New York; James Brown, and Robert Alexander, Philadelphia. Executive committee—Henry A. Sage, Ogdensburg, N. Y., chairman; J. F. Tapley, New York; Gordon J. Scott, Frank Le Bar, and William S. Janney, Philadelphia. Resolutions were adopted looking to the immediate erection of a large manufacturing plant. The claim is made that the electrical machinery produced by the company will reduce the cost of electric lighting to one-third of the present cost, and that on electric railways the saving will be over 50 per cent. in construction and operating expenses. The company will manufacture, under the Scott patents, alternating and direct current apparatus, motors, dynamos, lamps and transformers. Considerable emphasis is laid on the Scott controller, as a means of effecting marked economy in operation. Mr. A. Langstaff Johnston, the well known civil and electrical engineer, makes a favorable report on the appliance. The shops of the company are at Twenty-second Street and Washington Avenue, Philadelphia.

ASPECTS OF EXPORT TRADE.—There is considerable pleasure felt in electrical circles as to the growth of exports in this line, but not a little speculation as to whether the growth can be maintained. The reason for doubt is the establishment of huge plants abroad, which while borrowing American plans, models and ideas will become exporters themselves to colonial markets and in various ways will head off export trade from these shores. This is a contingency that is being faced at the present moment by some of the largest American concerns that have hitherto been able to sell through their own foreign sub-companies, but must now change their course or policy. It may result in a greater amount of assembling of parts and then putting on the local name plate. In the main the tendency toward a diversification of electrical exports is so great that while some items may be lost, the whole trade may continue to expand, for the reason that making in bulk here will be cheaper. There is a well authenticated case of rights to make some electrical apparatus being sold in England to parties who soon found it to their advantage to have the machinery built in the United States by the concern transferring the rights, as part of the general run of work, rather than turning it out in the retail, special way that such work has hitherto been done in England.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical material were made from the port of New York, ending Aug. 23: Antwerp—43 cases electrical material $3819. Aberdeen—9 cases electrical material $293. Brazil—15 cases electrical material $401. Berlin—2 cases electrical material $925; 2 cases electrical machinery $175. Bremen—6 cases electrical machinery $140; 1 case electrical material $10. British West Indies—59 cases electrical material $668. Cuba—9 packages electrical material $169; 615 packages electrical machinery $15,949. Central America—2 cases electrical material $82. Hamburg—69 packages electrical material $3,456.20; boxes motors $3770. Hull—5 cases electrical machinery $460. Havre—120 packages electrical material $8769; 5 cases electrical machinery $200. Japan—67 packages electrical material $3750. Liverpool—96 packages electrical material $10,329. London—17 cases electrical material $892; 4 cases electrical machinery $3850. Mexico—1 package electrical material $70. New Zealand—1 case electrical material $15. St. Petersburg—4 cases electrical material $285. Santo Domingo—4 cases electrical material $53; 1 case electrical machinery $310. Venezuela—8 packages electrical material $694. Zurich—7 packages electrical material $113.

MISSISSIPPI VALLEY AUTOMOBILE TRANSPORTATION COMPANY.—This is a new corporation which has been formed at St. Louis, with a capital of $500,000, to operate electric and other vehicles, principally in St. Louis. It has made arrangements with the Woods Motor Vehicle Company, of Chicago, successors to the Fischer Equipment Company, for a supply of cabs and carriages, the latter to be leased to private parties and the former to be introduced for public hire. Delivery wagons will also be leased to local merchants under the care of the company's experts. Herbert A. Wagner, the president, is general superintendent of the Missouri Edison Electric Company, and one of the largest stockholders of the Wagner Electric Company. The secretary and treasurer is H. R. Gamble. It is understood that the company will become a large customer for current from the stations under Mr. Wagner's management, and that automobile stables will be established by it at once. This is but another indication of the interest taken in automobilism all over the country, by electric light men, who see in it a splendid opportunity for increasing the day load of their plants and building up a distinctively new business.

MESSRS. T. PRINGLE & SON, hydraulic and mechanical engineers, of Montreal, have been awarded the contract for the erection of a large electrical power plant at Chaudiere, which is located some six miles from Levis, Que. The idea is to furnish light and electrical power to the City of Levis and the smaller places in the immediate neighborhood. The company which has been organized is known as the Canadian Electric Light Company, of Levis. The necessary power will be obtained by damming the Chaudiere River. From this dam will extend three pipes, each 8 feet 3 in. in diameter, to a site 800 feet below, where the powerhouse will be constructed. This will give a drop of 114 feet and the power generated in this way will be equal to 6000-hp. The dam on the Chaudiere will extend straight across a distance of about 1000 feet. Six double turbines of about 1400-hp each will be installed, and the current will be generated by six two-phased alternating dynamos of 1000-hp each. Work upon the plant will begin at once,

INCANDESCENT LAMPS.—Reports have been current as to some kind of proposed new deal or agreement between the incandescent lamp manufacturers, but inquiry does not develop any new state of affairs. Another report is that the General Electric Company has a new vacuum lamp "up its sleeve" and may produce it at any moment in a commercial and economical form. Then there is the Westinghouse Company with its interesting Nernst lamp, so full of possibilities in certain lines of lighting that neither the arc nor the incandescent has touched. Evidently the end of improvement is not yet and we shall see what we shall see, even if it be an advance in the price of incandescent lamps to a point more satisfactory to those who make them.

WESTINGHOUSE, CHURCH, KERR & COMPANY have just received additional orders from the Florida East Coast Hotel Company for five 90-hp Westinghouse gasoline engines, to be built by the Westinghouse Machine Company, Pittsburg. The Westinghouse Electric Manufacturing Company will supply the generators for the engines which are to be used to light five hotels in the South. Early this year three hotels of the Florida East Coast System, situated at Nassau, B. W. Indies, Ormond and Miami, Fla., were furnished with Westinghouse lighting plants driven by gasoline engines. The three plants have proven so satisfactory that the company has determined to fit up five more of their hotels in a similar manner.

APPARATUS NEEDED.—Mr. Paul T. Kenny, electrical engineer and contractor, Bennett Building, New York City, informs us that he is in the market for the following machinery either new or second hand. For isolated plant No. 1: Two 25-kw, one 50-kw and one 75-kw 120 volt compound wound dynamos direct connected to engines of suitable sizes and speeds to work at 80 pounds pressure. For isolated plant No. 2. Also a 100-hp automatic cut off engine and two belted dynamos of about 30-kw. 120 volt each with switchboard. For isolated plant No. 3 he wants one 50 and one 125-kw 230 volt dynamo of the belted type with suitable engines for same at 80 pounds.

Special Correspondence.

NEW YORK NOTES.

New York, Aug. 28, 1899.

NO WATER FOR BROOKLYN FOUNTAIN.—The electric fountain at Prospect Plaza, Brooklyn, which has heretofore entertained such large crowds, will not be operated again this year, because Commissioner Moffett, of the Department of Water Supply, says he cannot spare the water.

MUNICIPAL ELECTRICIANS' CONVENTION.—The New York and New England delegates to the convention of Municipal Electricians at Wilmington, Del., will leave this city at 2:15 p. m. on Monday, Sept. 4, by the Pennsylvania Railroad, from the foot of Cortlandt Street. The opening ceremonies occur the same night. A busy, interesting and useful week is expected.

THE J. JONES & SON CO. employees gave their comrade, Mr. Tom Watson, a farewell—to bachelorhood—dinner at Avoca Villa, Bath Beach, on Monday last. Mr. Watson, who has been connected with this firm for five years, gave those present a little remembrance in the form of a handsome match safe. Every one made a speech wishing the future Mr. and Mrs. Watson all happiness. Mr. Jones, Jr., sang his favorite song, "We want all the orders we kin get," which was loudly applauded by the outside salesmen. An even dozen sat down and spent a very enjoyable evening.

REBUILDING ROADBED.—A new style of roadbed has been adopted by the Brooklyn Rapid Transit Railroad Company, and a gang of men is making the change on the Court Street route. Heavy girder rails are being laid upon beds of concrete 10 inches wide and a foot deep. No ties are used. The rails are held at proper distance by steel braces running crosswise. These in turn are kept in place by the granite paving blocks. President Rossiter says the new style of roadbed will make riding in trolley cars as smooth as bicycle riding on asphalt pavement.

BROOKLYN RAPID TRANSIT COMPANY is receiving 250 large cars and 900 40-hp motors. The equipment is being put in first class condition. Contracts have been let for 300 more open cars and for additions to the present car and repair shops by which work will be concentrated and a saving effected. There are 4000 tons of girder rail on hand. New methods of feeding the different lines have brought economy in the cost of power production. The large power house of the Nassau Company will be used for the elevated lines. The Lexington Avenue and Broadway lines will be ready in the early winter.

A NEW TROLLEY LINE.—President Edward Maher, of the Union Railway Company, which has a monopoly of trolley lines in the Borough of the Bronx, has announced that a new line from Bedford Park to William's Bridge will be constructed during the coming month. By the 1st of October cars will be running from the Bedford Park terminal to the White Plains road, William's Bridge, where transfers north or south will be given. This will prove a decided benefit to the residents of William's Bridge, Woodlawn and Wakefield, as much time will be saved in traveling to and from those growing suburbs of Greater New York.

TO BUY QUEENS TROLLEY ROADS.—The statement was made last week from an authoritative source that negotiations are about completed for the absorption of the trolley systems controlled by the New York & Queens County and the New York & North Shore Railroads by the Brooklyn Rapid Transit Company. The consideration for the transfer, it is said, will be more than $1,000,000. The New York & Queens and the New York & North Shore are the most important trolley systems in Queens Borough. The starting point of the systems is in Long Island City. From there branches extend to Ravenswood, the Astoria Ferry, Dutch Kills, Laurel Hill, Flushing and College Point. Last week the New York & North Shore obtained control of the franchise of the Whitestone & College Point road, which gives them a perpetual right of way to a road through Whitestone and College Point to the government reservation at Willetts Point. When this deal is completed the Brooklyn Rapid Transit will be in complete control of all the trolley systems in Queens Borough, with the exception of the lines belonging to the Long Island Electric Railroad.

TRACTION COMBINATION.—The rumors of an impending combination of New York City transit companies, which had wide currency about six weeks ago and have been heard from time to time for many months, were revived in Wall Street last week. In June it was said that the Metropolitan Street Railway Company and the Manhattan Railway Company were to be consolidated, with the possible addition also of the Third Avenue Railroad Company and the Brooklyn Rapid Transit Company. The report now, however, is that Manhattan and Brooklyn Rapid Transit are to be the contracting parties, and that President Rossiter, of the Rapid Transit Company, and Vice-President Skitt, of the Manhattan, have within the last few days had several "informal conferences" with a view to effecting a traffic agreement between their respective systems. The Brooklyn Rapid Transit Company controls the elevated railroads of that borough, and operates the trains on the Brooklyn Bridge. The Brooklyn elevated lines, like the Manhattan's, are being equipped with electricity, and on the completion of these improvements the only physical obstacle to the running of through elevated trains from East New York to Harlem—an obstacle which could be easily removed—would be the fact that the present terminus of the Bridge trains in Brooklyn is several feet higher than the Manhattan's City Hall station.

VANDERBILT ELECTRIC CABS.—The New York Central Railroad is to establish a model cab service. Officers of the company say that when completed the plans will provide the best service of the kind in the world. In the remodeled Grand Central Station a department covering a large area will be devoted to the enterprise. Mr. W. K. Vanderbilt himself is said to be the projector of this scheme to better accommodate the public. The vehicles to be installed will be electric ones. They will include all types, from the small coupé to large buses, capable of carrying baggage as well as passengers. It is intimated that the plan may have much wider scope than merely the accommodation of passengers going to and from the Grand Central Station. At the start enough vehicles will be in commission to meet all the requirements of New York Central, Harlem and New Haven trains. It is not improbable, when so much is satisfactorily accomplished, that the service will be broadened to afford advantages to other than railway passengers. Mr. Vanderbilt is credited with the theory that such extension of the service will work direct advantages to the New York Central Company—involving the idea that the local public, as regular patrons of the railroad, can feel entitled to its facilities, whether immediately going to or from a train, or not. It is said that the automobiles will be of the Woods design.

RAMAPO WATER.—A great stir has been made over the plan to bring a high pressure water supply to New York City from the Ramapo Mountains, and politics and corruption are said to be rife in the scheme. It is not generally noted that the plan would not only add to the water supply but furnish an abundance of power. The Ramapo Water Company has secured the rights to the watersheds in several mountainous counties. For more than a year people throughout Ulster County have wondered to what use the monster dam near Napanoch, the site of the State Reformatory, was to be put. The dam is the second largest in the United States, and impounds a quantity of water second only to that impounded by the great dam at Holyoke, Mass. It is called the Honk Falls Dam, and is supposed to belong to the Honk Falls Electrical Power Company. Now, it is stated that the Ramapo Water Company is the real owner of the big dam. The Ramapo Company has all of the lands and water rights procurable along the Rondout Creek and its tributaries under option. At Dashville Falls, Rifton, Eddyville and other places there are great falls of water. This power, it is thought, will be utilized by the company. Although the options secured in Ulster and in most of the other counties will expire on April 1, 1900, the Ramapo Company has arranged to have some options renewed at that time upon the payment of a small additional fee.

PHILADELPHIA NOTES.

Philadelphia, Pa., Aug. 28, 1899.

AUTOMOBILES have been excluded from Fairmount Park, in Philadelphia, until regulations for their guidance can be prepared.

CHINATOWN has been cleaned up by the Board of Health, and the inspector reports that "a liberal use of electrozone was made in several yards."

LUCAS & GLIEM, electrical contractors, etc., have put an electric light plant in the Adams worsted mills, at Manayunk, Pa., and one at the Sterling mills, Bridgeport, Pa.

AMERICAN ELECTRIC LIGHT COMPANY.—A charter has been issued at Harrisburg to the American Electric Light Company, of Bloomsburg, Pa., with a capital stock of $90,000. It has bought out the local light plant.

VULCANITE FIBRE.—The business of the Vulcanite Fibre Company, of Wilmington, Del., has grown to such an extent that they have been compelled to add to their already large works. The new building will be a three-story brick addition to their old factory and will be 135 by 30 feet. Mr. Frank Taylor, of this concern, reports that they were never so busy in the history of the company as at present.

POTTSVILLE ELECTRIC LINES ABSORBED.—All the lines of street railway operated heretofore by the Schuylkill Electric Railway Company have been absorbed by the Pottsville Union Traction Company. This means that all the various electric lines leading to Pottsville have come under one management. The deed of assignment from C. P. King, president of the Schuylkill Electric Railway Company, has been filed.

INJUNCTION AGAINST A TROLLEY.—Chief Burgess M. C. Farrow and Solicitor J. W. Gillespie filed a bill of complaint in behalf of the borough against the Shamokin & Mount Carmel Street Railway Company, causing an injunction to be issued by the court, restraining the trolley company from tearing out its tracks on Sunbury Street, between Rock and Liberty Streets, Shamokin. The injunction was served upon President G. M. Smith and Directors M. Markle and T. M. Righter, of the street railway company.

A WOODBURY ENTERPRISE.—A certificate of incorporation has been filed in the County Clerk's office this week by the Woodbury Ice & Power Company, the incorporators being Job Scott, of Mantua; Daniel V. Summerill, Sr., of Pennsgrove, and Samuel L. Franklin, of Woodbury, N. J. The certificate states that the object for which the corporation is formed is to generate, buy and sell electricity and electromotive force for light, heat, power and other purposes; to carry on the business of cold storage in all its branches, etc.

IN THE COKE REGION.—W. D. Chapman, W. D. Chapman, Jr., F. J. Boucher, of Akron, O., and F. W. Hicks, W. W. Staub, of Pittsburg, and F. M. Morrison, of Mount Pleasant, have secured an option on the Uniontown street railroad and on the Connellsville, New Haven & Leisenring electric railway, and propose to connect it with the Uniontown road at Lemont. They will extend the road south from here six miles to Fairchance, and north from Connellsville, 12 miles to Mount Pleasant via Scottdale, making one continuous electric trolley line from one end of the coke region to the other.

INCREASE IN CAMDEN VALUATION.—City Counsel Bleakley, of Camden, has announced that the Board of Appeals had decided to grant the petition filed by him for an increased assessment on the property of the Camden Horse Railroad Company to $900,000, as follows: Tracks, rails and ties, $400,000; interest and estate in the land on which tracks are laid, called right of way, $500,000. This sum is to be added to the $216,000 already assessed, making the total assessment $1,116,000. It stated that the Camden Horse Railroad Company, through its counsel, would apply for a writ of certiorari as soon as they were officially notified of the action of the commission.

THE RAILWAYS COMPANY GENERAL.—Articles of incorporation were filed in Camden last week by Edwin F. Glenn, for the Railways Company General, capitalized at $10,000,000. The object of the company is the pur-

chase and operation of railways. Mr. Glenn, when asked as to who was interested in the new concern, said the company is composed entirely of Philadelphia capitalists, but he did not care to say as yet who they are. "I am the temporary president," he added, "but next week permanent officers will be chosen. The object of the company is the operation and purchase of railways, practically the same business as that carried on by the American Railways Company."

THE FARMERS AND THE TROLLEYS.—The suit against Samuel Hunt, president of the Farmers' Association, by the Camden & Suburban Railway Company for $5000 for blocking its cars on the Haddonfield turnpike in nowise has frightened the farmers, and, under the advice of their counsel, they are still paying toll and keeping to the right of the centre of the road, as the law directs. This, of course, includes a section of the trolley company's tracks and not only results in interfering with the schedule, but causes much inconvenience to the trolley passengers. While the farmers recognize this, they claim they have rights that must be respected, and say that if they pay toll the road is theirs to a great extent. Some of the leading spirits of the trolley company are largely interested in the turnpike.

DELAWARE TROLLEYS.—The talk of an electric railway for Kent County was renewed last week, when the Diamond State Construction Company, of Dover, which has a capital stock of $100,000, filed its certificate of incorporation in the office of the Secretary of State, and deposited in the Farmers' Bank and the First National Bank of Dover several thousand dollars to be used in accomplishing the company's primary object. The new company is independent of the concerns in which John D. Hawkins, president of the original Kent County trolley road, is interested. The capitalization of $100,000 does not represent the full value of the stock to be issued by the new company. The new company is composed of Leo Belmont, Morris Bernheimer, William Graham and Col. George F. Leland, of Philadelphia, and Attorney General White, Recorder Lord and others, of Dover. The action of the new company is approved and the towns between Dover and Milford will be canvassed to ascertain the sentiment of their citizens. The farmers along the proposed route from Milford to Woodland Beach will also be consulted. Permission to occupy State and Lockerman streets, Dover, will be requested. If the Town Council grants the request the company will macadamize those streets or pave them with stone, as the Council may direct. The company will also put fountains and flower beds in the public square.

NEW ENGLAND NOTES.

Boston, Mass., Aug. 28, 1899.

PORTLAND, ME.—The Belknap Motor Company will, it is said, begin the manufacture of automobiles, using storage batteries for motive power.

ATTENTIC AUTOMOBILE MANUFACTURING COMPANY has been formed at Portland, for dealing in self-propelled vehicles. Capital, $500,000. Incorporators, H. Adams, of Kingston; W. F. Marsh, L. J. Wilber, E. H. Reynolds, A. R. Marsh, all of Brockton; Q. C. Bird, of East Bridgewater, Mass.

MR. EUGENE F. PHILLIPS, general manager of the American Electrical Works, of Providence, R. I., has issued invitations for the 21st annual Rhode Island clam dinner. It will be given at the Pomham Club on Saturday, Sept. 9, and a large gathering of electrical men is expected to enjoy once more an exposition of the gospel of hospitality according to the Phillipians. The invitations are printed and issued on sheet copper.

NEW BEDFORD, MASS.—At the annual meeting of the New Bedford Gas & Edison Light Company, it was voted to reduce the number of directors from 13 to 11, and that a quorum of the board should be six. The directors elected were Messrs. H. G. Howland, Thomas H. Knowles, Jr., Charles R. Price, Geo. R. Stetson, Charles H. Lawton, F. Taber, A. G. Pierce, Oliver Prescott, Jr., John S. Perry and H. M. Knowles; treasurer and clerk, Charles R. Price.

NEW HAVEN, CONN.—The Connecticut shareholders in the Torrington & Winchester Street Railway Company, of Torrington, have just bought out the interests of the Boston owners, and expect shortly to have all of it. The road is one of the best in the state, and will now be put into still better condition. The Connecticut Light & Power Company have made an offer for the road, which is now being considered.

WRENTHAM, MASS.—A new street railway company has been formed for building a trolley line from the Foxboro line to Lake Pearl, with a capital of $35,000. The directors, including men well known in electrical Boston, are David W. Dunn, E. J. Whitaker, H. A. Cowell, J. H. Diamond, of Wrentham; Charls E. Bibber, Rufus H. Sawyer, of Malden, and Henry W. Burgett, of Brookline. The largest subscribers to the stock are Messrs. Sawyer, Bibber and Burgett, but many Wrentham men are interested in the company. The line from Foxboro to the Wrentham boundary is already built, and when completed to Lake Pearl it will not be surprising to see other extensions of the system.

CHICAGO NOTES.

Chicago, Ill., Aug. 26, 1899.

SYCAMORE, ILL.—The Sycamore & De Kalb Electric Railway Company has been formed for operating an electric railway. Capital, $10,000. Incorporators, E. P. Magill, of Sycamore; W. H. Scott, W. C. Durkes, all of De Kalb.

MR. S. F. PERKINS, president of the Planters' Manufacturing Company, Lake Mary, Fla., reports that they are building a factory, 100 by 300 feet, with 100-hp engines, boilers, electric plant, factory telephones, dry kilns, etc., and would be pleased to receive bids with catalogues.

BENTON HARBOR, MICH.—A franchise was granted by the City Council for the construction of an electric railway in this city, which means the establishment of an electric line along the lake shore from Benton Harbor to South Haven, touching at Paw Paw Lake, Pottawattamie Park, and other points.

THE EDISON DEAL, to which copious reference has already been made, proposes to give the stockholders, for each $100 share now earning 8 per cent., $200 in 4 per cent. bonds and a bonus of 50 per cent. in stock of the new company. Putting the bonds at 90 and stock at 10, that is $190 for $100 of old stock.

THE WINONA TELEPHONE COMPANY, which is rebuilding and enlarging its exchange, has contracted with the Sterling Electric Company, of Chicago, for the complete installation of its central office equipment in the new quarters. The apparatus consists of switchboards, distributing boards, toll desks, monitor desks, combined cable terminals and praticlers, pole top cable terminals and tubular line fuses.

AURORA, ILL.—Organization of the Aurora, Yorkville & Morris Electric Railway Company has been completed. The officers are: President and treasurer, Senator H. H. Evans, Aurora; vice-president, Upshaw Hord, Aurora; secretary, Senator Case, Chicago. Senator Aspinwall, of Freeport, and Vine A. Watkins, of Chicago, are on the board of directors. The contract for building the road as far south as Montgomery has been let.

THE LIGHTING OUTLOOK.—A question rising now in the local electric lighting field, also the gas field, is what attitude will be assumed by the eastern syndicate, buying up the Edison interests, toward the Cosmopolitan Electric and the Ogden Gas companies. The Cosmoplitan has laid considerable conduit mileage, while the Ogden Gas Company has developed a nice territory on the North Side. The controlling interest in the two concerns is identical. The agreement between the Ogden and the People's Gas Company expires next May. Both are making preparations apparently for trouble. But the People's Company is now in a position to secure extra support in a fighting policy against the Ogden owing to the coming into the local field of the eastern syndicate. As to the Cosmopolitan Electric, it will be in direct competition with the syndicate. The two companies on the outside are, to be sure, not large, but are in a position to be very irritating, especially the Ogden.

CINCINNATI NOTES.

Cincinnati, Aug. 26, 1899.

MR. H. S. ROGERS, chief engineer of the General Electric Company's Cincinnati headquarters, is on his vacation.

MR. F. A. FRESHNEY has succeeded Mr. Thomas J. Ryan as local manager for the Fort Wayne Electric Corporation.

MR. E. H. MULLEN, of the General Electric Company, was in town Thursday. He left the next day for Pittsburg en route back to New York headquarters.

C., L. & A. ROAD.—Mr. J. B. Crankshaw, electrical engineer of the Cincinnati, Lawrenceburg & Aurora Railway, states that they have selected a site at North Bend for their power house and will begin work at once.

COLUMBUS, OHIO.—The Columbus Railway Company has been incorporated; $7,000,000 capital stock in 35,000 shares. The purpose is to consolidate the Columbus Street Railway and the Columbus Central railway companies.

THE CLEVELAND OFFICE of the General Electric Company has secured the contract for the power equipment to be used in the Custom House and Post Office. It was a $3000 contract. The Cincinnati office has made a number of very satisfactory contracts recently. Among these are a fine plant for the Plate Glass Trust's new factory in Toledo, the Ford plate glass works, which started Tuesday, the 22d.

CINCINNATI TROLLEYS.—The report from office of City Auditor Boyden shows that the amount of cash fares received, according to the examiner, in 1898, by the Consolidated, reached the sum of $2,701,911.57, and from sign advertising in the cars the company received $11,707.58. The examiner finds discrepancies between the reports to the city and the facts, as developed by the books of the company, to the amount of $22,767.71, on which he reports the city as entitled to 5 per cent. The company, however, as appears by the report, disputes the right of the city in the premises.

PRESIDENT SAMUEL W. GLOVER, of the Post-Glover Electric Company, is enthusiastic over business conditions: "Business with us," he says, "is better than ever before in the history of our establishment." The company is furnishing the supplies for a new plant for the Boys' Industrial School at Blanchester, Ohio; an additional plant for the National Home for Disabled Volunteers (central branch), at "O. M. I.," near Dayton, Ohio; and has just finished a contract for wiring the Custom House, Cincinnati, with supplies for the new electric light plant, amounting to $7000.

MR. J. C. HOBART, secretary and manager of the Triumph Electric Company, has the heartfelt sympathy of the entire community over his recent bereavement. The loss of a favorite brother and an idolized son at the same time was enough to break his heart. Everett, the brother, was a young lawyer full of promise; Harold, the son, was a bright little fellow of tender age. They were drowned in Traverse Bay. The father left Cincinnati Friday, the 18th, to spend his vacation with them, and arrived just in time to find them cold in death. Mr. W. N. Hobart, the father of Everett and grandfather of Harold, arrived in Cincinnati Saturday, the 19th, from his California trip in time to get the message announcing the fatalities.

VICE-PRESIDENT JOSEPH NEAVE, of the Bullock Electric Company, has just returned from his foreign trip which extended over a period of three months. Mr. Neave is in excellent health. Designed for pleasure and recreation, his jaunt was all that and more to him. While in Russia he established under conditions most favorable for the company a Russian agency, with headquarters in Moscow. In Germany, France and England also Mr. Neave located agencies, and made himself familiar with trade conditions that will materially increase the firm's already excellent reputation in those countries. An order has very recently been closed by the Bullock Company for four of their complete teaser systems of printing press equipment, to be set up in the plant of *The Scotsman* in Edinburgh, Scotland.

PITTSBURG NOTES.

Pittsburg, Aug. 26, 1899.

MR. W. J. LONGMORE, the purchasing agent of the Westinghouse Electric and Manufacturing Company, has returned from his vacation at the seashore.

MR. PAUL DENNINGHOFF, of Berlin, Germany, who is said to represent an electric railway syndicate from that city, is now traveling in this country, investigating the methods of American electric rapid transit. He was in this city for several days last week, and left here for Chicago.

PROFESSORS R. A. FESSENDEN and John A. Brashear, respectively instructors of electricity and physics at the Western Pennsylvania University, were elected vice-presidents of the American Association for the Advancement of Science at the annual meeting of that organization, held in Columbus, Ohio, yesterday.

AMBLER, PA.—The Inland Trolley Company is looking over the country from Lansdale to Chestnut Hill, and has filed an application at Harrisburg for a charter to build a line between those two places. The route would take in the towns of North Wales, Springhouse, Ambler, Fort Washington and Flourtown, and a very thickly populated and rich farming district.

MR. E. C. MEANS, who for many years was chief draughtsman of the Westinghouse Electric Manufacturing Company, and who for the last two years has been living in Denver on account of his health, was in this city last week, renewing old acquaintanceships. Mr. Means is now connected with the Colorado Electric Light & Power Company, of Denver, Col.

ST. LOUIS NOTES.

St. Louis, Aug. 26, 1899.

CAPT. ROBERT M'CULLOCH, who resigned recently from the position of division superintendent for the United Railways Company, gave a farewell dinner at the Southern Hotel last Saturday night to about a dozen of his old associates in the employ of the National lines.

CONVERTED INTO AN ELECTRIC LINE.—The St. Louis traction road, formerly the People's Railway, is being converted into an electric line. The stringing of the overhead trolley wire is about complete. A large feed cable is now being strung along the California avenue line.

MR. J. W. JENS has been appointed superintendent of roadway and tracks of the United Railways Company, and Mr. John J. Lechter superintendent of overhead construction and feed lines, and Mr. Boyce superintendent of construction of power house and machinery of the same system.

MR. JOSEPH S. MINARY, formerly secretary and superintendent of the Southern Electric Railroad Company, who was elected assistant auditor of the United Railways Company a couple of weeks ago, has been promoted to the position of division manager, made vacant by the resignation of Capt. Robert McCulloch.

KINLOCH TELEPHONE TO WEBSTER.—The Kinloch Telephone Company completed a line to Webster Groves last week, using the poles of the St. Louis & Suburban Railroad Company, and formed a circuit with the Webster Groves telephones. The line will be extended to connect with Kerkwova central office, which will throw St. Louis, Webster Groves and Kerkwova into direct communication.

THE RAILWAY TELEGRAPHERS.—The committee appointed at the last convention to select between St. Louis and Chicago as to which city should get the headquarters of the Brotherhood of Railway Telegraphers of the United States and Canada, have decided on St. Louis, and the headquarters will be moved here Sept. 20. St. Louis, it was decided, was on the main line of travel from everywhere, and business could be transacted from here better than from anywhere else in the country.

TROLLEY CHANGES TO BE MADE.—A universal color scheme will be inaugurated by the new management of the United Railways Company. It is said that the shade of yellow now used on the Olive street cable cars will be adopted for all of the street cars belonging to the United Railways Company. The cars will also be made a uniform size, and will be equipped similarly. A universal uniform for all employees of the company as well as uniform badges will also be adopted.

MR. ERNEST B. DENISON, superintendent of construction of the Kinloch Telephone Company, and Miss Hattie M. Inge were married Aug. 23, in the rooms of the St. Louis Baptist Association, this city, by Rev. E. Anderson, pastor of the Grand Avenue Baptist Church. Both are from Mobile, Ala., where they belong to prominent families. Mr. Denison moved here two years ago, and accepted a position with the Kinloch Telephone Company, for whom he is now superintendent of construction.

DAY LINES GET EXTENSION.—The ordinance introduced some time ago granting extensions of franchises to the Day companies was passed last week by the Belleville Council, after being amended to require the companies to keep the streets in repair between the rails and one foot on each side. Under the ordinance all the franchises heretofore granted will expire Sept. 1, 1919. The reason given by the company for desiring the extensions was that it might be enabled to dispose of 20-year bonds.

WILL LEASE THE UNITED LINES.—A meeting of the stockholders of the St. Louis Transit Company has been called for Sept. 21, for the purpose of increasing the capital stock from $3000 to $20,000,000. The object of this is to lease all the street car lines purchased in this city by Brown Bros. & Co. The street car lines will first be formally absorbed by the United Railways Company, which was incorporated for that purpose. After the consolidation details are completed, the street railway properties will be leased to the St. Louis Transit Company, and operated under that name.

PACIFIC COAST NOTES.

San Francisco, Aug. 21, 1899.

THE SUNSET TELEPHONE & TELEGRAPH COMPANY, through Secretary F. W. Eaton, recently published a notice for a stockholders' meeting, to be held Sept. 8 next. A proposition will be voted upon to create a further bonded indebtedness of the Sunset Company in the sum of $2,250,000. The meeting will be held at the company's office, 216 Bush street, San Francisco.

SAN RAFAEL RAILWAY.—An electric railway is projected, connecting San Rafael, Cal., with San Francisco. The electric line would extend from San Rafael, via Ross Valley, to Point McNear. Thence a line of steamers would convey the passengers to San Francisco, the entire distance being covered in less than one hour. Mr. John McNear, of Petaluma, who is making extensive improvements on the water front at the Point, is the prime mover in the enterprise.

THE TRUCKEE RIVER PLANT.—It is reported that the Cheap Power Committee of the Comstock Pumping Association has decided against the new plan for installing a steam plant costing about $150,000, to be owned by the mining companies. The proposition of the Truckee River General Electric Company has again been taken up, and the probabilities are that the contract will be speedily closed so that construction work may be completed during this year.

SAN JOAQUIN ELECTRIC COMPANY.—A suit has been filed in the United States Court, in Los Angeles, Cal., by the Mercantile Trust Company, of New York, against the San Joaquin Electric Company, which owns a fine water power plant in Fresno. The suit arises from the failure of the Electric Company to meet the January interest upon its bonds, which had been sold to the amount of $650,000. The Trust Company asks that the Electric Company be placed in the hands of a receiver and for a restraining order to prevent any property from being disposed of pending the result of the suit.

CANADIAN NOTES.

Ottawa, Ont., Aug. 26, 1899.

ALMONTE, ONT.—A by-law to raise $30,000 by debentures for the purpose of installing a municipal electric light plant has been given its second reading in council. The ratepayers will vote on the question Sept. 25.

ORILLIA, ONT.—The Engineering Contract Company, of New York, through its Canadian agency, has been figuring on the proposed power transmission scheme, with a view to taking over the contract abandoned by the Central Construction Company.

TO DEVELOP A NEW BRUNSWICK WATER POWER.—For over a year the scheme of utilizing the water of the St. John River, at Grand Falls, N. B., for the purpose of generating electricity, has been in contemplation. Among those interested in the scheme are Sir William Van Horne and Senator Proctor, of Vermont. The council informed the senator that they would give his company a lease if he would guarantee an expenditure of $250,000 within 18 months. The senator, it is reported, was favorable to this argument, and as a result engineers are now making surveys, measurements, etc.

THE RAGGED RAPIDS TRANSMISSION CONTRACT.—The statement recently made that the Royal Electric Company, of Montreal, had received the contract for installing machinery for the development of power at Ragged Rapids and its transmission to Orillia, Ont., seems to be incorrect. Mr. F. Strickland, superintendent for the Electrical Maintenance & Construction Company, of Toronto, now states that the latter company has been awarded the whole contract, including the construction of a power house at Ragged Rapids, dams and machinery and overhead wires. Mr. Strickland says that this is the first instance in Canada where a municipality has undertaken to develop and transmit electric energy such a long distance, the Rapids being 20 miles from Orillia. The Toronto Company has undertaken to put in plant capable of developing 5000-hp for supplying light, heat and power to the whole town of Orillia, by Dec. 1 next. The work was at first entrusted to a Buffalo firm, which subsequently backed out, and the contract was then awarded to the Toronto Company at an advance in price. The contract price is $71,000.

THE SHAWINIGAN FALLS POWER PLANT.—It is difficult to realize the changes made in the neighborhood of Shawinigan Falls, on the St. Lawrence River, since the Shawinigan Water & Power Company began the development of the water power at that place—a development which will eventually be carried out to the extent of 150,000-hp. The Shawinigan Company, which has a capital of $6,000,000, first had to provide means of communication with the outside world, and this was done by building a branch railway, 4½ miles long, to connect with the Great Northern Railway. This gives a direct route to Quebec, and Montreal is reached by the branch of the C. P. R. running down to Three Rivers. The Shawinigan Company bought not only the water power rights from the government, but also 800 acres of land immediately adjoining that which it is now surveying and laying out into town lots, roadways, etc. The company, some months ago, gave to the Warren Scharf Company, of New York, the contract for a canal, bulkheads, power house, etc., and it is expected that this work will be completed by January next, when the necessary dynamos and other electrical machinery will be at once installed for the production of 50,000-hp. Meanwhile the Shawinigan Company has been busy disposing of its wares—that is to say, it is developing, and has already made contracts of the sale of an amount of power which puts it immediately in the front rank of the greatest power companies of the world. Among the enterprises which will locate there is the Canadian Carbide Company, which has contracted for the use of 10,000-hp. The Shawinigan Company has also made a contract for the sale of 10,000-hp to the Pittsburg Reduction Company, which will install a plant for the manufacture of aluminum on a large scale. This company, which has a capital of $1,600,000, will be the first to manufacture aluminum in Canada, and will employ between 400 and 500 men.

INDIANA NOTES.

Indianapolis, Ind., Aug. 26, 1899.

TELEPHONE STOCK PURCHASED.—S. M. Foster and other capitalists of Fort Wayne have purchased the entire stock of the National Telephone & Telegraph Company, a long distance line through Ohio, Indiana and Michigan.

ANDERSON, IND.—The Union Traction Company has let a contract to a Pittsburg company for 54 miles of rails for the Gas Belt Electric Railway Indianapolis line. The contract price was $193,966, which is just 32 per cent. more than rails sold for last year.

IRON POLES VS. WOODEN POLES.—The city of Elkhart has filed an appeal in the Supreme Court against the Indiana Electric Railway Company, to compel it to erect iron poles instead of wooden ones in the city limits of Elkhart. The case was decided against the city by the trial court.

YOUNG WOMEN CONDUCTORS.—The street cars at Richmond were under charge of young women as conductors on Aug. 16. Every church in the city, both Protestant and Catholic, appointed women members of their congregations for the work. The day's proceeds are to go to hospital work in the city.

CONTRACT LET.—A contract for the construction of an electric railway line from Irvington (a suburb of Indianapolis) to Knightstown has been let to the Kirkpatrick Construction Company, of Indianapolis. The contract price is $750,000. It also specifies that the line shall be completed and at least six cars operating within 18 months.

A CONTEST OVER AN ELECTRIC LINE.—There is a spirited contest between the cities of Lima and Lagrange, to secure the Northeastern Indiana Electric Railway, a line to be built between Orlando and Goshen. The business men of Lima have offered a substantial bonus if the road be built through Lima and not touch Lagrange. It is the latter town's next bid, and it is said the business men will probably outbid the former and secure the road.

A RECEIVER ASKED.—The Commercial electric light plant, of Columbus, Ind., was advertised to be sold at sheriff's sale Aug. 19, to satisfy a judgment for $1000 held by William Brockman. The stockholders and directors held a meeting the evening before and early the next day filed a petition for a receiver. The sale was postponed. It is understood that the gas company contemplated getting hold of the plant through the proposed sale, but was blocked by the receivership petition.

AUTOMOBILES FOR GOVERNMENT SERVICE.—The company engaged in manufacturing automobiles in Kokomo has received word from W. G. Edens, the assistant superintendent, that he will be in Kokomo in a few days to witness a test of its machines, with a view of adoption by the government in the postal service. The Kokomo company will have ready besides other machines a carrette of the same pattern recently shipped to Puerto Rico. It weighs less than a ton, seats six persons comfortably and has sustained a speed of 20 miles an hour over the indifferent roads of Howard County with six passengers.

ORGANIZATION EFFECTED.—The directors of the Logansport, Rochester & Northern Traction Company have effected an organization by the election of the following officers: President, J. T. McNary, of Logansport; vice-president, L. W. Welker, of Albion; secretary, George W. Holman, of Rochester; treasurer, B. F. Keesling, of Logansport; civil engineer, W. A. Osmer, of Logansport. The company has accepted the franchise offered by the council of Logansport for rights of way over certain streets in that city. A Cincinnati contracting firm are thought to be the successful bidders for the work, which it is hoped to begin soon.

SOUTHERN NOTES.

Memphis, Tenn., Aug. 26, 1899.

THE CUMBERLAND TELEPHONE COMPANY, operating a larger part of Tennessee, Mississippi, Louisiana and a portion of Kentucky, under the Bell system, made a net gain during the fiscal year ending June 30, of 8554 subscribers and had 24,927 in operation July 1.

MESSRS. C. W. BOLTON, of Pontotoc; L. B. Camp, of Amory, and Ward Dawson, of Okolona, Miss., are the most active telephone workers in the southwest. Together they have about 400 miles of toll lines, besides two independent exchanges. Their lines are connected and extend from Middleton, Tenn., through Mississippi to points in Alabama, with many branches.

CUMBERLAND TELEPHONE COMPANY.—The independent telephone companies at Vicksburg, Jackson, Miss.; Natchez, Port Gibson, Greenwood, Baton Rouge, Shreveport, Franklin, Lake Charles, La.; Clarksville, Tenn.; Murfreesboro, Fayetteville, Columbia, Florence, Selma, Owensboro and Henderson, Ky., have sold out their plants and property to the Cumberland (Bell) Telephone Company at a price far below their original cost.

NEW TELEPHONES are being put in and more attention is being given to "trouble" by our local Cumberland Telephone Company since the Memphis Telephone Company's canvassers have started out. Mr. L. P. Curtis, manager of this new company, was up from New Orleans recently and expressed himself as being well pleased with the work of canvassing so far. Up to date between 600 and 700 contracts have been secured at $4 per month for business and $2.50 per month for residences.

MR. LELAND HUME, general manager and secretary of the Cumberland Telephone & Telegraph Company, is about as busy as any telephone man in this section. Since his company absorbed the Southern Bell Company, he has large territory to travel over. He is not only a good telephone man, but a thorough business man and makes friends wherever he goes. Mr. Hume was born in Mississippi and educated at Nashville, Tenn., from which city he came to Memphis to manage the local exchange. He lived here five or six years until he was elected secretary and manager of the company.

Washington, D. C., Aug. 28, 1899.

RICHMOND, VA.—It is reported that the Boyd-Newton syndicate, the provisional purchasers of the Richmond Railway & Electric Company, will reconstruct the lines of its railroad.

HUNTINGTON, W. VA.—Ohio Valley Electric Railway Company has been organized at Huntington, to build and operate a railroad from Huntington to Ironton, Ohio. Capital, $1,000,000. Incorporators: T. J. Bryan, H. S. Cato, C. W. Watts, H. C. Duncan, Jr., L. T. Vinson, all of Huntington.

RICHMOND, VA.—The sale of the Richmond Railway & Electric Company's street car lines to what is known as the Boyd-Newton syndicate of local capitalists, has been announced. The sale includes the main line and all the branches of the road, forming seventy-odd miles of track. The interests of the bondholders in the old company are represented by $5,000,000 worth of scrip.

WASHINGTON, D. C.—The Georgetown & Tenleytown electric railroad will shortly commence the entire reconstruction of its line, from M street out to the District line, and thence to Rockville. It is expected the work will be completed by the first part of December, when new rolling stock will be placed on the line and connections made so as to permit the running on the tracks of the Metropolitan cars to the eastern section of Washington.

FREDERICK CITY, MD.—New York and Philadelphia capitalists have become interested in the Frederick, Thurmont & Northern Electric Railroad over the mountains in this county. The line will be 20 miles in length, and the estimated cost is $400,000. The project is part of the big scheme for an electric road from Washington, D. C., to the Gettysburg battlefield. The line is in course of construction from Washington to Rockville, Md.

RICHMOND, VA.—A deal involving the transfer of ownership of nearly two and a half million dollars' of property was completed a few days ago, when the syndicate above noted took over the properties of the Richmond Railway & Electric Company and allied lines. The company proposes to thoroughly equip the properties, including both trackage and rolling stock, with the most modern appliances when the City Council shall have granted the new owners the necessary franchises. The franchises now running will expire next year.

Chattanooga, Tenn., Aug. 26, 1899.

INSULATOR PIN FACTORY.—R. P. Johnson, J. S. Mitchell and L. H. Kincer will establish a plant for manufacturing insulator pins for telephone and telegraph poles at Hillville, Tenn.

CHATTANOOGA, TENN.—A syndicate of Chicago capitalists has been organized for the purpose of purchasing the lines of the Chattanooga Electric Street Railway Company. T. S. Mordaunt, general manager of the Vicksburg (Miss.) lines, is engineering the deal. An option for 30 days has been given the syndicate on the properties. A deal has been planned with the Hambleton syndicate of Baltimore, but before the money was paid over a hitch occurred. This deal includes all the Lookout mountain lines.

KNOXVILLE, TENN.—The People's Telephone & Telegraph Company, of this city, one of the largest independent telephone companies in the south, has again begun extending its lines into the territory covered by the East Tennessee Telephone Company. Lines are being built eastward to connect with the independent companies at Bristol, and southward to Chattanooga and intermediate points. The company expects to have connection with Dalton, Ga., and later will extend to Atlanta, while eastern connection will be made at Bristol with the large eastern cities.

CHATTANOOGA, TENN.—The Mayor and Board of Aldermen have taken a hand in the fight against the electric street railway company, in sympathy with the locked-out union motormen. The board passed an ordinance requiring all motormen employed by the road hereafter to take fifteen days' instructions under an expert motorman before they can serve on the road. The board also declared forfeited certain "sleeping" franchises heretofore granted the company, and passed an ordinance on the first reading granting a rival company a right of way on important streets. The railroad company will fight these measures in the courts.

Kansas City, Mo., Aug. 26, 1899.

TELEPHONY.—Mayor Jones has vetoed an ordinance granting a franchise to the Independent Telephone Company, which agreed to put in a system in opposition to that of the Missouri & Kansas Telephone Company, to charge very much lower rates, and to pay the city 3 per cent. of its receipts. The principal ground for the veto is that competition between telephone companies is not desirable, rendering it necessary for business concerns to patronize both systems, thus greatly increasing their expenses.

TOPEKA, KAN.—The Missouri & Kansas Telephone Company of Kansas, and the Missouri & Kansas Telephone Company, of Missouri, have filed reports. The Kansas Company reports that in 1889 it leased its plant and territory to the Missouri Company for 99 years, the consideration being payment of indebtedness, taxes, liens and one dollar per annum, and the preservation of the property. The Missouri & Kansas Telephone Company, of Missouri, reports a paid-up capital of $250,000, and personal property valued at $291,388.73. Its receipts for 1898 were $127,787.65. It paid dividends aggregating $12,500, and has undivided profits amounting to $8798.30.

MISSOURI-KANSAS TELEPHONE COMPANY.—A contract between the Missouri & Kansas Telephone Company, of Kansas City, Mo., and the Standard Telephone Company, of Kansas City, Mo., has been completed, whereby the Missouri & Kansas Telephone Company purchases lines of the Standard Telephone Company, and the Standard Telephone Company secures the use of the Bell instruments on all its lines, making direct physical connection at all junction points. The Standard Telephone Company owns and operates about 11,000 miles of lines within the state of Missouri, and under the present arrangement it expects to double its mileage within a year. The Standard Telephone Company has a capital of $30,000, and has been in operation a little over a year. The board was recently reorganized and the new officers are as follows: S. H. Bevins, president; Charles Webster, vice-president and general manager, and Samuel J. Agnew, secretary.

General News.

THE TELEGRAPH AND TELEPHONE.

COLUMBUS, OHIO.—The Franklin Telephone Company has been incorporated, with a capital stock of $50,000.

COLUMBUS, OHIO.—The National Telephone Company, of Columbus, has been incorporated, with a capital stock of $10,000.

ARLINGTON, GA.—The Blakely (Ga.) Telephone Company is putting in a telephone exchange at Arlington.

TRENTON, N. J.—The Continental Telephone, Telegraph & Cable Company, with a capital of $1,000,000, has been incorporated here.

WILMINGTON, DEL.—The Delaware & Atlantic Telephone Company will extend its lines from Paulsboro to Pennsgrove, thence across the Delaware to Wilmington.

BIG SPRINGS, TEX.—Mrs. J. E. Brewer has made arrangements with the business men and citizens to construct a telephone line. Construction will begin on the line soon.

THE HOME TELEPHONE COMPANY has been organized at Kearney, Neb., to construct and operate telephone lines; capital, $15,000; incorporators, F. H. Gilcrest, J. S. Adair, J. G. Lowe.

AURORA, IND.—The Northwestern Telephone Company has been granted a franchise in Aurora. Construction work is not, however, to be begun until contracts for 300 telephones have been secured.

NATIONAL TELEPHONE DEVICE COMPANY has been formed at San Francisco, with a capital stock of $100,000. The directors are J. Kahn, C. K. Rosenberg, A. M. Brown, N. Schlesinger and N. A. Judd.

PORTLAND, ME.—The Dirigo Telephone Company, which has been operating a few lines in Farmington and other parts of Maine will, it is said, soon endeavor to enter Portland in competition with the present telephone company.

WABASH, IND.—The Home Telephone Company has declared its semi-annual dividend of 3 per cent. Four years ago the plant was installed at a cost of $20,000. The exchange list has 325 paying subscribers and is steadily growing.

GUTHRIE, O. T.—A number of business men of Stillwell and Perkins have organized a company and will construct a telephone line between the two Payne county towns. The men interested are W. A. Knipe, John Youst, Richard Hicks and Cliff Rock.

LEXINGTON, VA.—A telephone line is about to be constructed between Lexington and Lynchburg. The section of the line nearest Lynchburg will be built by the Lynchburg Telephone Company and the Lexington section by the Lexington Telephone Company. The distance is about 40 miles.

LOUISVILLE, KY.—P. A. Steinau, controlling the franchise of the Louisville Underground Conduit Telegraph & Telephone Company (incorporated some years ago, with a capital stock of $1,000,000), proposes the establishment under that franchise of the new telephone system in Louisville.

KANSAS CITY, MO.—The Independent Telephone Company will ask the council to pass a new franchise ordinance. The new ordinance is largely the same, in wording as well as effect, as the ordinance vetoed by the mayor, except that it attempts to avoid the features the mayor objected to.

CROSSVILLE, GA.—The Gainesboro Telephone Company has completed all arrangements for putting in an exchange at this place. Work upon the toll line from this point to Pikeville is in progress. The line will run from this place to Grassy Cove, thence across Walden's Ridge to Squatchie Valley and down to Pikeville.

DETROIT, MICH.—A contract has been let by the Michigan Telephone Company to A. Chapoton, Jr., for a brick and stone telephone exchange to replace the present inadequate "West" exchange on Dix Avenue. The new branch will accommodate 3600 subscribers and will be located on the corner of Dix and Ferdinand Avenues. Donaldson & Meier are the architects.

GREENVILLE, PA.—The Union Telephone & Telegraph Company, of Baltimore, Md., has purchased a controlling interest in the Mercer County Telephone & Telegraph Company, and will immediately commence to extend and improve the line. Brown Bros., the Baltimore bankers, are backing the deal. Complete plants are being put in at Erie, Pa., and Conneaut, Ohio.

MANSFIELD, OHIO.—The Star Telephone Company will put a toll station in this city, two cars of poles having arrived. The connection will be made with Ashland, the line between the two cities now being under way of construction. It is expected to have it completed by Nov. 1. The Star Telephone line connects with most all of the towns in the southern part of Richland County.

EDGERTON, WIS.—The Edgerton Telephone Company has perfected the organization by electing the following officers: President, F. W. Coon; vice-president, W. A. Shelley; secretary and treasurer, L. E. Gettle. The Edgerton Telephone Company is organized with a capital of $6000. The new exchange which is being built will start in with 60 subscribers and have a switchboard capacity for 120.

SYRACUSE, N. Y.—The Syracuse, Rochester & Lake Ontario Telephone Company, to operate in Syracuse, Rochester, Oswego, Auburn, Geneva and intermediate places, has been incorporated. The capitalization is $100,000, and the directors are Sherman E. Bishop, Alvin B. Bishop, A. M. Graham, of Clyde; Jacob Strauss, William Scott, C. H. Towlerton, of Lyons, and E. S. Bishop, of Rhinebeck.

TELEPHONE EXTENSION.—The New Long Distance Telephone Company has almost completed its line between Richmond and Cambridge City Another line will be built by way of Liberty, both to be operated in connection with the Home Telephone Company. The United States Telephone Company is building a line through Ohio to Richmond, and will complete it before winter. The Home Company has awarded contracts for building special lines to College Corner, Ohio; Greenville, Ohio; Camden, Ohio, and Winchester, Ind.

SALT LAKE.—By Sept. 1 the Rocky Mountain Bell Telephone Company expects to have a line operating from Salt Lake to the coast. The line to Dillon, Mont., will be completed by that date, and thus connection will be made with the line from the coast now being operated to Dillon. The new line from Dubois, Idaho, to Ogden is practically completed. Workmen are at present stringing two additional copper wires between Ogden and Salt Lake, and as soon as a gap in Montana is strung with wire the line from Salt Lake to the coast will be ready for business. The two additional wires between Ogden and Salt Lake will give the cities four circuits instead of two, as formerly, and will greatly facilitate business between the two points.

GROWTH OF ERIE TELEPHONE.—A very brisk canvass is now being put forth by the management of the Erie Telephone system under Mr. C. E. Nestor, of San Francisco, Cal. The plan is one adopted by General John I. Sabin, of the Pacific Coast Telephone companies, and so successfully carried out in Oregon, Washington and California since 1895, making the Pacific Coast companies the largest in ratio to population of any telephone interest in the world. San Francisco, with an estimated population of 300,000, is now operating 14,750 subscribers. The Erie system as now made up had on Jan. 1, 62,743 subscribers, during the past seven months the net gain has been 23,931, to which should be added 7200 waiting connection, making a total of 30,931 as a result of the seven months' canvass, or 40 per cent. of their entire subscription list. On July 1 the subscription list was about 10,000 ahead of the construction force, and for that reason the canvassers were reduced to a nominal number in each of the 20 test cities.

ELECTRIC LIGHT AND POWER.

RICHMOND, TEX.—The Richmond Electric Company has been formed, with a capital stock of $4000.

WATERFORD, PA.—The electric light plant was destroyed by fire on Aug. 19, with a loss of $5000.

VICTORIA, B. C.—The electric light station is to be enlarged and an additional plant put in under the supervision of Engineer C. H. Topp.

TUSCUMBIA, ALA.—The city has granted a franchise to W. H. Sawtelle and associates for the construction of electric light plant and water works.

PIERRE, S. D.—The Empire Light Company, with a capital stock of $100,000, has been formed by E. L. Squire, G. C. Spencer and L. C. Smith.

SOUTH DAKOTA.—The Rockland County Chemical Battery Light, Heat & Power Company has been formed by W. A. Tubbs, W. Eberlee and G. V. Pattison, with a capital stock of $100,000.

CHAMPLAIN, N. Y.—The Champlain Electric Company has been formed. Capital, $15,000. Incorporators: J. H. Crook, of Champlain; D. C. White, of Cooperville; H. Hogle, of Lacolle, Quebec.

LYNCHBURG, VA.—The Lynchburg Street Railway & Electric Power Company has awarded a contract for its proposed power house. It will be equipped throughout with the latest improved machinery.

VINCENNES, IND.—It is stated that the Vincennes Electric Company, the Electric Street Railway and the Gas Light Company have been consolidated through the efforts of the Hambleton banking house, of Baltimore.

BENNETTSVILLE, S. C.—T. W. Bouchier, H. L. McColl, J. M. Jackson and others have incorporated the Bennettsville Light & Power Company for the establishment of an electric light and power plant; capital stock, $5000.

HARRISON, O.—The Harrison (O.) Water Works and Electric Light Plant have been sold by A. M. Miller, the New York owner, to James A. Graft. The price paid is not known, as a nominal sum was named in the deed.

SPARTANBURG, S. C.—The Spartanburg Railway, Gas & Electric Light Company has been incorporated, with a capital stock of $150,000, by P. H. Gadsden and William Austin, of Charleston, F. H. Knox, of Pittsburg, Pa., and others.

ATLANTA, GA.—H. L. McKee, Walter H. Harrison, W. W. Draper, S. Crowley and others have incorporated the Atlanta & Roswell Electric Railway & Power Company for establishment of electric power plant, etc.; capital stock, $500,000.

THE KNOXVILLE ELECTRIC COMPANY, Knoxville, Tenn., has been incorporated to supply light, heat and power; capital, $1000. The incorporators are J. P. Moore, C. D. Lockwood, W. Adams, J. Moss, A. Caldwell, all of Knoxville.

MILTON, DEL.—A franchise for an electric light plant has been granted to James P. Morrison, Charles P. Taylor, Frederick H. Russell and Charles W. Cullen. Work on the plant will be commenced within six months, and under the conditions of the franchise it must be completed within 18 months.

WORCESTER, MASS.—A syndicate, comprising Herbert S. Shaw, John W. Dobbie and N. T. Hurlbut, of Webster, and H. S. Pratt, of Worcester, has closed a deal whereby it purchased the controlling interests of the People's Light & Power Company's plant in Danielson, Conn. Mr. Shaw is superintendent of the Webster electric light plant, and Messrs. Dobbie and Hurlbut are directors. The purchased plant is capitalized at $90,000. It will be entirely remodeled and improved.

OMAHA, NEB.—A determined effort is to be made by the Omaha City Council to force all electric light wires in the city underground. This means everything but the trolley wires. The electric light company has offered to compromise by agreeing to shut off the current whenever there is an alarm of fire sounded. The City Council Committee refuses to accept these conditions, holding that the franchises of these companies force them to put the wires underground whenever the demand is made by the city.

THE ELECTRIC RAILWAY.

PHOENIX, N. Y.—Mr. Edward Quirk, of Fulton, has been granted a trolley franchise.

COLUMBIANA, OHIO.—A stock company is being formed for the construction of an electric line from Youngstown south to this city, a distance of 16 miles.

DETROIT, MICH.—The Detroit Automobile Company has taken a three years' lease of the building formerly occupied by the Detroit Motor Company. Mr. Henry Ford is superintendent.

YOUNGSTOWN, OHIO.—William C. Manchester, representing Detroit capitalists, has filed an application with the County Commissioners, for a franchise to construct an electric line from Youngstown to Salem, a distance of 20 miles.

TERRE HAUTE, IND.—Mr. Alvin M. Higgins is arranging for the building of horseless carriages at the Terre Haute Carriage & Buggy Company. Mr. Higgins will make arrangements by which the motors will be sent to the factory ready to be attached to carriages, trucks, delivery wagons, etc.

BOSTON, MASS.—Officials of the Massachusetts Electric Companies confirm the purchase of the Taunton & Brockton Street Railway Company. This company operates thirteen miles of road and is a short line between Brockton and Taunton. It is capitalized for $100,000 stock, and $100,000 5 per cent. bonds.

WILLIAMSPORT, PA.—Sheriff Gamble has levied on the personal property of the Jersey Shore Electrical Company, and the Sheriff levied on the personal effects of the Montoursville Passenger Railway Company. In both instances the attorneys representing the creditors did not want to tie up the plants.

DOWNINGTOWN, PA.—The Borough Council of this place has granted the Philadelphia & West Chester Traction Company the right to lay its tracks on Lancaster Avenue. At the same time a rival company known as the West Chester & Downingtown Railway Company was given the privilege of entering the town.

COLUMBUS, OHIO.—The Columbus & Lancaster Traction Company will build the street railroad line from Columbus to Lancaster. This company has been granted the franchise, and everything is now in readiness to begin work on the road. Judge Dwyer, of Dayton, is president, his son is secretary and Dr. Wagenhals, of Columbus, is vice-president.

PUEBLO, COL.—Work wil be commenced early in September on a $25,000 addition to the power house of the Pueblo Street Railroad Company. The new structure will have a frontage of 50 feet, and extend 100 feet west of the main power house. This improvement has been badly needed by the company for some months, owing to increase in the business.

AIKEN, S. C., and Augusta are to be connected by an electric railway. A charter has been applied for by the Aiken & Augusta Electric Power Company. The capital stock is to be $25,000. Charles Warren Davis, of Graniteville; J. W. Ashurst and James Powell, of Aiken; H. Gould Barrett, Edward S. Johnson and Bryan Lawrence, of Augusta, are the corporators.

COLUMBUS, OHIO.—The Columbus Street Railway will be sold at receiver's sale Sept. 13. The appraisers fix the total value of the property at $1,080,620, which is considerably short of the claim held by the Cleveland Trust Company against the road, which amounts to $1,700,000. The property has been divided into three parcels, and may be bid in at two-thirds of the appraisement.

ELIZABETH, N. J.—After several months of delay and opposition, the Elizabeth & Westfield Street Railway Company, New Jersey, has presented to the Westfield, N. J., township committee a satisfactory route for its line from that place to Scotch Plains, to connect with the Plainfield Street Railway Company's line, and complete the link necessary to make a through line from Plainfield to Elizabeth.

ANNAPOLIS, MD.—The incorporation of the Washington, Sandy Spring & Gettysburg Railway Company has been recorded. The road begins at Harney, in Carroll County, and runs through Carroll, Howard and Montgomery Counties to Silver Spring. The capital stock is $100,000. The incorporators are Ed C. Peter, of Montgomery County; Albert Gleason and J. Enos Ray, of Prince George's County, and George H. Harris and John B. Larner, of Washington, D. C.

CHICAGO, ILL.—The Chicago Union Traction Company is earning at the rate of 3 per cent. on common. Dividends on preferred will begin in October at the rate of 5 per cent., or at the rate of 1¼ per cent. quarterly. The leases of the companies operated by it run from June 1, but it did not secure control until July 1. Earnings for July were $40,000 more than for the same month last year. For the first eleven days of August they were $22,000 more than for the same time last year.

CAMDEN, N. J.—Counsel for the Camden & Suburban Railway Company has instituted proceedings in the Supreme Court against Charles Pitman, a huckster, of Haddonfield, to recover $2000 damages for maliciously obstructing the cars of that corporation, on the Haddonfield turnpike. The trolley company is determined to break up the practice of the drivers of vehicles obstructing their cars, and will prosecute all parties who further attempt to place any hindrance in the operation of their cars.

MARYLAND.—The certificate of incorporation of the Washington, Sandy Spring & Gettysburg Railway Company has been filed in the executive department at Annapolis. The incorporators are Edward C. Peter, of Montgomery County; Albert Gleason, J. Enos Ray, of Prince George's, and George H. Harris and John B. Larner, of Washington City. The termini of the road are Harney, in Carroll County, and near Silver Spring, in Montgomery. The road runs through Carroll, Howard and Montgomery counties, and has power to construct lateral branches to Frederick and Chillum, in Prince George's. It is to be operated by steam, electricity or any other power that may be adopted. The capital stock is $100,000.

NEWARK, N. J.—The promoters of the new electric system of railroads to connect New York with Morristown, Lake Hopatcong, Montclair, and other points in New Jersey held a meeting in Morristown to complete plans and arrangements for the construction of the road. The promoters believe that work on the Montclair and Morristown division will be started on Sept. 1. The road, it is said, will run on private property, and the tracks are to be of eighty-pound steel rails, rock-ballasted. It is intended to run a branch of the road from Whippany to Rockaway, by way of Parsippany, Boonton and Danville, and at Rockaway to connect with the Central Railroad of New Jersey, over whose tracks it will run to Lake Hopatcong.

THE AUTOMOBILE.

DENVER, COL., is to have an automobile factory, in which Mr. G. T. Emerson, of Philadelphia, and W. A. Perry will be interested.

METROPOLITAN AUTOMOBILE BAZAAR has been incorporated in New Jersey, to manufacture automobiles, etc. Capital, $250,000. Incorporators, Charles H. Burr, Jr., William J. Eidell, Frank R. Hansell.

McLEAN AUTOMOBILE COMPANY has been formed in New Jersey, with a capital stock of $100,000, by J. P. McLean, W. W. Hess and W. A. Black. The headquarters are the New Jersey Corporation Guarantee & Trust Company Building, Camden, N. J.

AN AUTOMOBILE SYSTEM will, it is reported, soon be in operation in Cleveland. It is to be run on schedule time in competition with the street car lines. The automobiles used will be covered and will be heated in cold weather. Each will seat about 40 persons. It is expected that a number will be in operation within 60 days.

MONTCLAIR, N. J.—The automobile fad has reached this place. Several wealthy residents have purchased them, and a general improvement of the streets is being advocated. The citizens believe that the horseless vehicles will soon be seen on the streets in large numbers Dr. Henry Power was the first resident to purchase a carriage, and his example has been followed by Kirk Brown and others.

AUTOMOBILE STAGES.—S. T. Lloyd, a lawyer of Atwood, is organizing a company to operate an automobile stage line from Trenton, Neb., to Colby, Kan., a distance of 65 miles. The country is level and the roads good. If this line is a success it is proposed to put in others. The organizers say that the motor will be able to make the trip from Trenton to Colby and return in one day, a total distance of 130 miles.

REPORTED AUTOMOBILE CONSOLIDATION.—It was reported last week that arrangements had been made for the consolidation of the Automobile Company of America, the Winton Motor Carriage Company, the National Motor Carriage Company and the Manhattan Motor Carriage Company into a single concern, to be known as the American Automobile Company and to have a capital of $10,000,000, of which $4500 is to be in preferred stock. It was also reported that the Canda Manufacturing Company would be taken into the deal. Charles J. Canda, when questioned last week, said that he knew nothing about the new company. The names of Messrs. Whitney, Widener and others are freely used.

EDUCATIONAL.

Y. M. C. A. EVENING SCHOOLS.—The International Committee of Young Men's Christian Associations has issued the annual report and the prospectus concerning the educational work and the evening schools in the Young Men's Christian Associations of North America. The report gives in detail the record of the year's work, including that of the 100 schools taking the international examinations, the list of 972 successful students, and the names of the 106 ccolleges and universities now granting recognition to the international certificates. The prospectus contains a brief outline of the movement, its objects, the list of examiners, the syllabi or outline courses in the 24 subjects now provided, including the six new courses added this year; also the regulations governing the international examinations and the complete sets of questions used last year.

LEGAL.

ELECTROLYSIS SUIT AT SPOKANE.—The much talked of electrolysis case of the Spokane-Washington Gas Company against the Spokane City Railways has been brought to an end so far as the Superior Court is concerned. Judge Richardson, in his finding, rules that the gas pipes of the Spokane Gas Company have been materially damaged by electrolysis, due to a current from the system of the Spokane Street Railway Company. An injunction will be granted, to prevent the street railway company from using any except cast-welded joints on paved streets, and some approved bond, such as the "Chicago" bond, in other streets. This suit was begun last October, and was on trial four weeks, the principal expert witnesses being Professor E. Darrow, of the Washington State College, and Mr. Bert L. Baldwin, consulting engineer, of Cincinnati, O. At the conclusion of the argument Judge Richardson took the case under advisement, and the substance of this finding is: (1) The only method of absolutely preventing stray currents is the double trolley system. (2) The best single trolley system uses the cast weld joint. (3) The best wire bond is known as the Chicago bond. (4) That it is not practicable to use cast weld joints, except where the street is paved, with some such material as asphalt, granite, brick, etc. (5) That it is shown by the evidence in this case that the gas pipes of plaintiff have been injured by electrolysis. (6) That such injury has been caused by defective bonding of the street railway system, and an injunction is granted to prevent defendant from injuring the plaintiff and ordering de-

fendant to cast weld all joints in paved streets, and place Chicago bonds on all other streets. It is probable that the railway company will take an appeal from this decision.

PERSONAL.

MR. C. A. COFFIN, of the General Electric Company, has gone to England.

MR. U. N. BETHELL, general manager of the New York Telephone Company, is taking a brief European trip for rest and recreation.

MR. L. SCHMIDT, of the Schmidt & Bruckner Electric Company, New York, sailed for Europe last Tuesday, to be gone about one month.

MR. T. R. TALTAVALL, associate editor of THE ELECTRICAL WORLD AND ENGINEER, is making a flying holiday trip through England and Holland.

SIR EDWARD FRANKLAND, the distinguished chemist, died August 18 at the age of 74. Prof. Frankland is known in electrical circles from his early work on the theory of the storage battery.

DR. N. S. KEITH, of San Francisco, is spending some weeks in the East. He is interested in several mining properties, but is just now paying considerable attention to automobile development.

MR. ISAAC POST, for many years identified with E. S. Greeley & Co. and recently with Stanley & Patterson, has accepted a position with the Manhattan Electrical Supply Company, of New York.

MR. LUDWIG EPSTEIN died August 18 at Virginia Water, England, aged 46 years. Mr. Epstein had for many years been identified with the accumulator industry, his energies being particularly directed towards reducing the weight of the storage battery.

PROF. R. B. OWENS, of the electrical engineering department at McGill University, Montreal, has returned to this country after a stay of some three months in England, where, as a holder of the Tyndall Fellowship, he has been doing some original investigation work at Cambridge, with Prof. J. J. Thomson.

MR. W. BUCHANAN, of the Electric Construction Company, England, and Mr. H. Dickinson, engineer, etc., of the Leeds municipal electric lighting department, have been making a tour of inspection through this country as far west as Chicago, and returned home to England last week, well pleased with their observations and reception.

MR. CHARLES E. F. AHLM, who has designed the electrical features of the automobile now being operated in Syracuse, N. Y., by the E. C. Stearns Company, of that city, is a graduate of the Royal Polytechnic Institute, of Stockholm. He was associated for some time with the old Walker Company, for whom he designed some power apparatus.

MR. J. H. HALLBERG, who has made considerable reputation for himself in electric lighting circles as a designer of enclosed arc lamps, has been appointed electrical engineer and designer for the arc lamp department of the General Incandescent Arc Light Company, of New York City, which has of late been making several additions to its expert staff.

LIEUT. W. J. MAXWELL has reported at the Brooklyn Navy Yard for duty in the new electrical laboratory in the equipment department. He came to the yard from the Bliss Torpedo Works, at Newport, R. I., where he had been on duty for the government. It is intended to familiarize Lieut. Maxwell with the work of this department, and then place him in charge of a similar laboratory at one of the other navy yards.

MR. JOSEPH BIJUR, who was formerly with the Walker Company as electrical engineer and manager of the New Haven factory and has of late been practicing in New York, has become associated with the Siemens-Halske Electric Company, for which Mr. Alex. Churchward is engineer-in-chief, with whom he is co-operating in the development of some important new lines of product. He is located at the Grant works of the company, near Chicago.

MR. LOUIS W. MILLER has been appointed city electrician of Rochester, N. Y., by the City Council, to succeed Mr. C. R. Barnes, who is now in the service of the state government. Mr. Miller is an old Western Union and New York Central operator, and since 1892 has been electrician of the police telegraph system. In 1898 he was made superintendent of that branch. The office of city electrician was dropped when Mr. Barnes resigned, but it has been found desirable to create it again and give Mr. Miller charge also of all wiring, etc.

Trade and Industrial Notes.

THE ELECTRIC APPLIANCE COMPANY, Chicago, are sending out descriptive circulars of their Newgard waterproof receptacles, as a boon where the weather or dampness has a chance to work on the lamp connections.

THE UNION METALLIC CARTRIDGE COMPANY, at Bridgeport, Conn., have placed an order with the Berlin Iron Bridge Company, of East Berlin, Conn., for an extension of their three-story factory building, on Barnum avenue, to a factory building on the opposite side of the street.

THE MERCHANTS' ELECTRIC COMPANY has been incorporated in New Jersey to manufacture electrical apparatus. Capital, $15,000. Incorporators, William G. Stickney, Charles C. Kelly, both of Jersey City, N. J.; Henry C. Newton, Paterson, N. J. The principal office is at 49 Montgomery Street, Jersey City, N. J.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Pa., have just issued a general circular of the courses of study taught by this institution. The courses embrace a wide variety of subjects. From the testimonials from many of the students it is evident that excellent work is being accomplished by the schools.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., has issued a very complete catalogue of its graphite productions for all uses. The catalogue has 62 pages, and is illustrated with cuts representing the great variety of articles in which graphite is used in one form or another. The cover is very attractive in design and contains colored pictures of many of the graphite productions.

THE SCHMIDT & BRUCKNER ELECTRIC COMPANY, Howard and Elm streets, New York, has been awarded the contract to equip Sherry's new building, Forty-fourth Street and Fifth Avenue, with board and 70 telephones of the automatic signal type, finished in mahogany and bird's-eye maple. They have also closed with the New York Hospital for a 50-drop board telephone generator system.

MR. H. T. HOCHHAUSEN, 67 Liberty Street, Brooklyn, has a well equipped factory for repairing and general electrical work of every description, especially high tension arc apparatus and marine electrical work. Since the Excelsior Electric Company went into the hands of a receiver, Mr. Hochhausen has been handling a large quantity of the apparatus of this concern, and has all their supply parts.

ELECTRIC MINE HAULAGE.—A catalogue upon underground electric haulage has been issued jointly by the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company. Electric mine locomotives produced by these manufacturers cannot fail to interest all mine proprietors who study economy in operating expenses. The catalogue illustrates and describes the locomotives, and contains tables of dimensions, and of the hauling capacity upon various grades.

MONTAUK MULTIPHASE CABLE.—A new and revised price list, installation and specification hand book, with facts regarding their specialty, has just been prepared and issued by the Montauk Multiphase Cable Company, 100 Broadway. It abounds in data, instructions, etc., as to this valuable improvement in the use of electricity as a protection from fire, water, burglars, etc. There is nothing that the electrician needs to know as to the installation of this cable that cannot be found in the pamphlet, and it opens up a remarkable field of new work. The price list No. 3 supersedes all others, and should be studied by all who are interested.

HYDRAULIC JACKS.—The Watson-Stillman Company, 204 East 43d street, New York, has issued a catalogue devoted to hydraulic jacks alone, in line with its policy of issuing sectional catalogues, subsidiary to an illtrated index. This contains an assortment of illustrated sheets, as stated at the head of the title page, and is known as Catalogue No. 54. The new matter in the catalogue is the preface and alphabetical index at the beginning of the book, additions to list of sizes of jacks on various sheets, and entirely new matter on sheets 125, 127 and 470, pages 54-18, 54-26 and 54-51. New tools are also shown on sheets 369, 465 and 466, pages 54-34, 54-35, and 54-36.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, report that they have closed recently several large telephone contracts. They have met with most flattering success with their new 1900 telephone. It embodies all the newest and most up-to-date ideas in the telephone line. Their telephone department has been greatly enlarged, and they are now carrying one of the largest stocks of telephones in the West. They are always glad to send their new telephone out on trial, with the privilege of returning it should it not be everything claimed. They have issued a number of circulars, etc., on new things in the telephone line, which they will mail on application.

THE WESTERN ELECTRIC COMPANY is carrying in stock some very neat novelties in the way of portable battery lamps. The emergency search, or flashlight, is made in three sizes, cylindrical in form, the diameter of all being the same, and their length being respectively 8½, 11 and 13 inches. These lights give from six to eight thousand flashes before the battery requires renewal. They are extremely useful where a light is wanted quickly. The Western Electric Company is distributing its catalogue descriptive of this device. This catalogue also illustrates the "Ever Ready" electric walking cane, interior searchlight, electric gas lighter, surgical and dental lamp, electric bicycle lamp, "Ever Ready" night lamp, electric candle, ornamental banquet lamp, electric ruby lamp for photography, portable reading lamp, the "Ever Ready" scarf pin, and other battery novelties. If any of our readers have not received a copy of this catalogue, it will be sent to them upon request.

FACTS ABOUT LIGHTING.—The architectural exhibition in the galleries in the St. Botolph Club, Boston, held recently, under the auspices of the Boston Architectural Club, and the Boston Society of Architects, contained over 300 exhibits. The old system of lighting was done away with, and Frink's patent reflectors for art galleries substituted with satisfactory results. The St. Botolph gallery is a comparatively small one, and, Mr. Frink says, presents essentially the same conditions he has found in many of the private galleries he has lighted. But the large galleries of the Metropolitan Museum of Art, in New York; the Carnegie Library, in Pittsburg, or the Corcoran Gallery, in Washington, will convince any one that the Frink system adapts itself to all conditions and dimensions. Gallery lighting, as well as the lighting of churches, theatres, and all kinds of audience rooms is a science founded upon the theory of reflection, but successfully developed only by practical experience. The reflecting and diffusing powers of various materials and surfaces, the proper angles for each particular set of conditions, and all the minor details of producing fixtures, have been Mr. Frink's study for forty years. The whole object of reflection of light is to divert rays that would naturally be wasted into the direction where they will be utilized. Reflection of light is, therefore, economy of light. The best reflecting surface, the most effective angles of reflction, are the greatest economy. The slightly extra cost of fixtures that are made right is soon made up by the greater economy. Mr. Frink is always ready to furnish estimates and suggest the most effective and economical lighting of any special apartment, and correspondence from parties who have problems that his long experience will help to a better solution will receive most careful attention. His address is No. 551 Pearl street, New York City.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED AUG. 22, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

631,271. TELEPHONE; J. G. Black, Lone Rock, Wis. App. filed March 4, 1898. Special devices are used whereby the listener at the telephone may cut out the induction coils and battery at his end of the line to avoid the resistance and self-induction, the device used being a little switch on the receiving instrument.

631,277. ELECTRIC ALARM WATER COLUMN; M. L. Bush and C. Swain, Lawrence, Pa. App. filed April 8, 1899. The movable parts of the device are at rest until the limits of the rise and fall of the water are reached; hence, the parts are not subjected to wear by every slight change in the height of the water or the foaming of the water in the boiler.

631,278. THERMOSTAT; J. Butcher, Jersey City, N. J. App. filed Oct. 22, 1898. The thermostat is a bar made up of a strip of glass and a strip of zinc whereby, it is claimed, a very sensitive instrument is produced.

631,289. MAXIMUM DEMAND METER; Walter C. Fish, Lynn, Mass. App. filed March 10, 1899. (See Current News and Notes.)

631,290. ELECTRIC METER; Walter C. Fish, Lynn, Mass. App. filed April 7, 1899. (See Current News and Notes.)

631,303. ELECTRIC SWITCH; G. W. Hart, West Hartford, Conn. App. filed Dec. 5, 1898. Details of construction of a quick acting push button switch.

631,304. SNAP SWITCH; G. W. Hart, West Hartford, Conn. App. filed Dec. 5, 1898. Details of construction of a quick action lever switch.

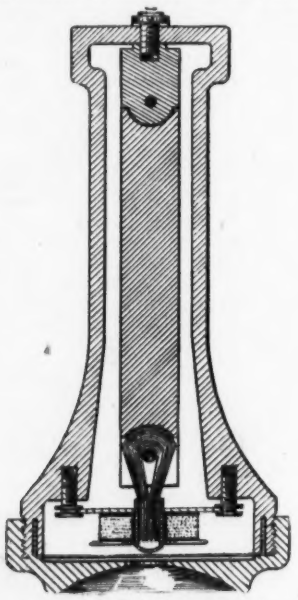
631,316. DEVICE FOR LIGHTING LAMPS BY ELECTRICITY; S. M. Meyer, New York. App. filed Feb. 5, 1898. The igniting device is a resistance which is brought to incandescence when the circuit is closed. A lever, which closes the circuit, serves to bring the resistance into working position, and a spring thereafter automatically removes the resistance so that it will not be in the flame of the lamp.

631,322. OXIDANT FOR ELECTRICAL BATTERIES; Leonard Paget, New York, N. Y. App. filed July 8, 1897. (See Current News and Notes.)

631,339. CLUTCH FOR ELECTRIC ARC LAMPS; H. C. Spinney, Lynn, Mass. App. filed April 13, 1899. The invention consists of a special adjusting device inserted between the clutch and its actuator.

631,343. SYSTEM OF ELECTRIC METERING; Elihu Thomson, Swampscott, Mass. App. filed March 21, 1898. (See Current News and Notes.)

631,354. TELEPHONE RECEIVER; J. A. Williams, Cleveland, Ohio. App. filed April 9, 1898. The bobbin is so supported on the magnet that its position with relation to the diaphragm remains constant notwithstanding the expansions and contractions of the case due to variations of temperature.



631,354-5.—Telephone Receiver.

631,355. TELEPHONE RECEIVER; J. A. Williams, Cleveland, Ohio. App. filed Aug. 9, 1898. General improvements in the construction of the case and mounting of the bobbin.

631,356. MAGNETO ELECTRIC TELEGRAPH; L. G. Wooley, Kenton, Ohio. App. filed Aug. 1, 1898. The transmitting key operates a device for generating instantaneous alternate electrical impulses, one at each movement of the key, said impulses being in one direction as the key is depressed and in the opposite direction as the key rises.

631360. ELECTRIC HEATER; J. L. Creveling, New York. App. filed Jan. 27, 1898. The invention relates to a core upon which the resistance coils are mounted, and to the method of supporting the core in a case. The core is cylindrical and in sections, each section provided with a coil retaining support.

631,393. ELECTRIC ARC LAMP; F. McIntosh, Schenectady, N. Y. App. filed July 16, 1897. The principal feature of the invention is a reflector, consisting of the usual curved surface, formed of porcelain and adapted to be brought to a white heat by the heat of the arc. The arrangement is intended to give a soft and evenly diffused light suitable for engraving and photographing.

631,361. TROLLEY POLE CATCHER; C. A. Davis and H. Wilson, Somerset, Mass. App. filed Nov. 18, 1898. Two weights are used on the end of the trolley rope. One of them normally keeps the rope taut and when the trolley leaves the wire the lifting pole carries its weight upward, where it trips a latch and allows the second weight to act upon the rope to pull down the trolley pole.

631,421. FAC-SIMILE TELEGRAPH; William P. Dulany and Thomas Mills, Cleveland, Ohio. App. filed Jan. 8, 1898. (See Current News and Notes.)

631,452. COLUMN PRINTING TELEGRAPH; J. E. Wright, New York. App. filed March 10, 1898. Improvements on a prior patent, No. 494,185.

631,453. TELEGRAPHIC RELAY; J. E. Wright, New York. App. filed March 10, 1898. The novel construction consists of two sets of contact stops and two vibrating tongues or armatures, the axes of which are connected in such a manner as to provide lost motion between them, one of the objects being to insure good contact.

631,454. TELEGRAPH TRANSMITTER; J. E. Wright, New York. App. filed May 5, 1899. In connection with a pin-barrel and a series of keys therefor, a locking device is provided and adapted to arrest the pin-barrel when any pin and its corresponding key are brought into engagement.

631,467. SYSTEM OF ELECTRIC METERING AND APPARATUS THEREFOR; Rudolph M. Hunter, Philadelphia, Pa. App. filed Nov. 15, 1898. (See Current News and Notes.)

631,503. ELECTRIC METER; Caryl D. Haskins, Newton, Mass. App. filed June 24, 1898. (See Current News and Notes.)

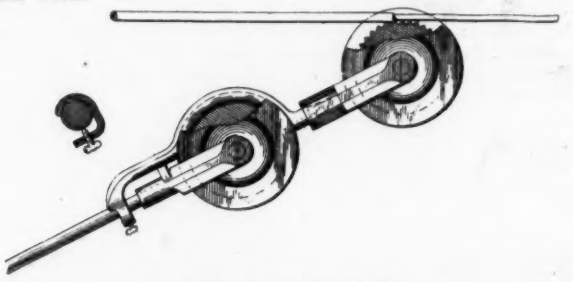
631,505. AUDIPHONE; Reese Hutchison, Mobile, Ala. App. filed March 15, 1899. The combination of a telephone receiver and transmitter for the use of partly deaf people as the intensity of its sound regulated by means of reverse coils of different resistance. As applied for instruction purposes, the individual instruments are in the main circuit connecting with the teacher's instrument. The connection is such that the teacher may instruct one pupil alone or all together and any pupil may cut himself out of circuit without disturbing the others.

631,511. ELECTRIC CLOCK; A. F. Poole, Washington, Pa. App. filed June 22, 1898. The invention consists in a form of liquid switch or circuit closer, and in a device for giving the switch a quick motion so as to insure a proper contact between the liquid and the corresponding terminal. The invention also includes means for closing the circuit a number of times where the current has not been strong enough to actuate the secondary clocks so as to bring these clocks to the same point as the master clock.

631,518. ELECTRIC MOTOR OR GENERATOR; J. Burke, New York. App. filed Dec. 27, 1898. The armature is mounted in a cradle which is secured to the main frame of the machine, the object being to insure coincidence between the axis of the armature and that of the armature space.

631,558. PHONOGRAPH; Josef Chania, of Lemberg, Austro-Hungary. App. filed Sept. 14, 1898. (See Current News and Notes.)

631,596. ATTACHMENT FOR TROLLEYS; H. Stuempfle and J. Delane, Terre Haute, Ind. App. filed Feb. 9, 1899. When necessary to use a sleet wheel, or any supplemental wheel, the same may be adjusted to the end of the pole by means of a peculiar arm and bracket without removing the regular wheel.



631,596.—Attachment for Trolleys.

631,623. ELECTRIC FOUNTAIN BRUSH; C. Diehl, Philadelphia, Pa. App. filed July 20, 1899. A fountain brush having a water supply tube attached thereto and having spraying perforations by which the water is directed through the bristles, and electrical connections by which the current is conducted to the water passing out from said perforations.

631,628. ELECTRIC LIGHTER FOR INCANDESCENT BURNERS; C. Farnham, Manchester, N. H. App. filed March 27, 1899. The invention consists of the mechanical devices for moving the sparking points with respect to each other.

631,633. ELECTRIC PUSH BUTTON CUT-OUT; J. A. Gunther, New York. App. filed April 15, 1899. An ordinary push button having quick break devices, one push of the button serving to complete the circuit and the next to break the circuit.

631,649. ELECTRIC ARC LAMP; G. R. McIntyre, New York. App. filed Feb. 28, 1898. An axial magnet lamp comprehending improvements principally in the carbon carrying sleeve and ball clutch.

631,733. ELECTRODE FOR ELECTRIC BELTS; F. G. Bonfils and J. A. Alkire, Jr., Denver, Colo. App. filed Jan. 9, 1899. The electrode consists of two disks and a bolt connecting them. One of the disks has a padded face and the bolt is connected electrically with the battery.

631,748. ELECTRIC LIGHTING DEVICE FOR INCANDESCENT GAS BURNERS; S. M. Meyer, New York. App. filed June 23, 1898. The electric lighting device first ignites a pilot light which, in turn, ignites the main burner and in the operation the key, which turns on the gas to both burners, also closes the circuit.

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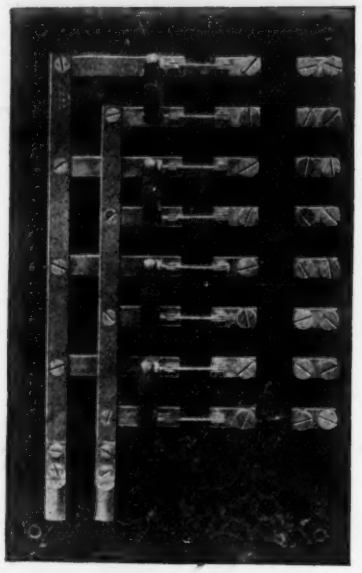

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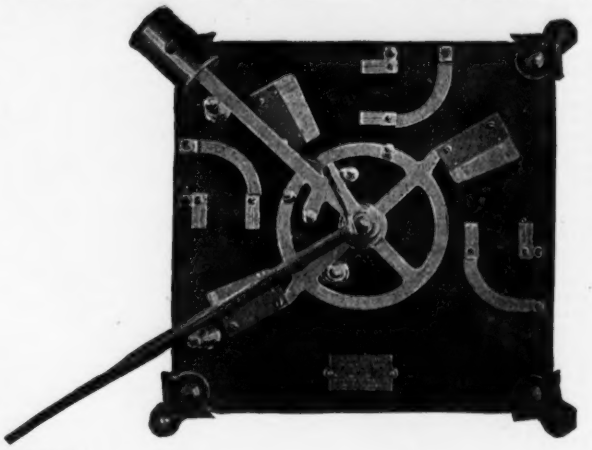

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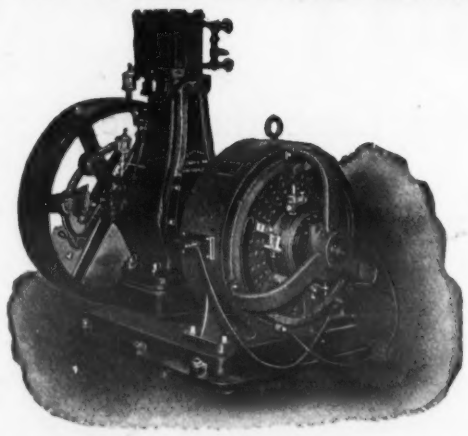

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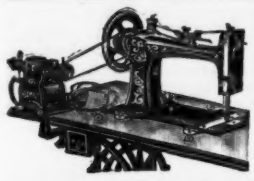

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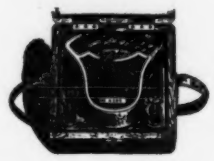

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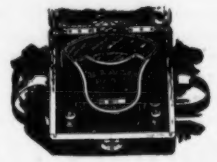

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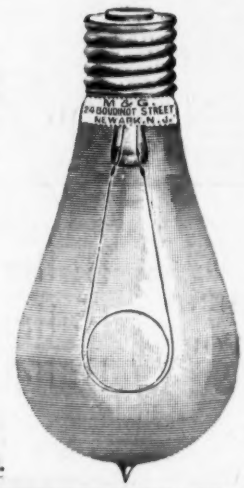

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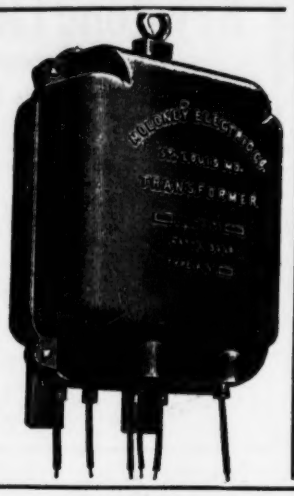

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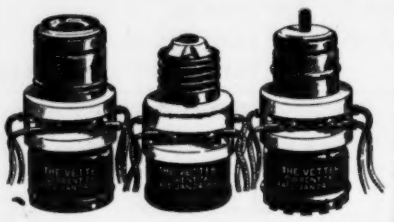

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